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EOSDIS Core System Project

**Interface Control Document Between
EOSDIS Core System (ECS)
and
TRMM Science Data and Information
System (TSDIS)**

June 1996



**— GODDARD SPACE FLIGHT CENTER —
GREENBELT, MARYLAND**

INTERFACE CONTROL DOCUMENT
between the
EOSDIS Core System (ECS) and the
TRMM Science Data and Information System
(TSDIS) for the ECS Project

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Preface

This document is a formal contract deliverable with an approval code 1. It requires Government review and approval prior to acceptance and use. This document is under ECS contractor configuration control. Once this document is approved, Contractor approved changes are handled in accordance with Class I and Class II change control requirements described in the EOS Configuration Management Plan, and changes to this document shall be made by document change notice (DCN) or by complete revision.

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Abstract

This Interface Control Document (ICD) defines the functional and physical design of each interface between the Earth Observing System Data and Information System (EOSDIS) Core System (ECS) and the Tropical Rainfall Measuring Mission (TRMM) Science Data and Information System (TSDIS), and includes the data contents and format for each interface. All modes (options) of data exchange for each interface are described as well as the conditions required for each mode or option. Additionally, data transfer frequencies and disposition of transferred files and messages are included. The sequence of exchanges are completely described (e.g., required handshaking). Communications protocols are also detailed for each interface.

This ICD is consistent with the TRMM Science Requirements document, the Earth Science Data and Information System (ESDIS) Project -- Level 2 Requirements, the Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System (ECS Level 3 requirements), and the Interface Requirement Document (IRD) Between ECS and the TRMM Ground System.

Keywords: TRMM, TSDIS, ICD, handshaking, products, interface, ECS, GSFC, DAAC, TSU, Metadata, Ancillary data

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1. Introduction

1.1 Identification

This Interface Control Document (ICD), Contract Data Requirement List (CDRL) Item 029, whose requirements are specified in Data Item Description (DID) 209/SE1, is a required deliverable under the Earth Observing System (EOS) Data and Information System (EOSDIS) Core System (ECS), Contract (NAS5-60000).

1.2 Scope

This ICD defines all of the system interfaces that exist between ECS and the Tropical Rainfall Measuring Mission (TRMM) Science Data and Information System (TSDIS), including the TSDIS Science Users (TSUs).

The Earth Science Data and Information System (ESDIS) Project has responsibility for the development and maintenance of this ICD with support by TSDIS. Any changes in the interface definition must be agreed to by the relevant participating parties, and then assessed at the ESDIS Project Level. This ICD is approved under the signatures of the ESDIS and TSDIS Project Managers.

ECS Releases are keyed to mission support: Release IR1 provides support to TRMM Early Interface Testing and Science Algorithm I&T. Release A provides support to TRMM Science Operations and TRMM Ground Systems Certification Testing. Release A also provides the functional capabilities needed to support early ESDIS Ground System Testing for the EOS AM-1 and Landsat 7 missions. Release B provides support to EOS AM-1 Mission Operations and Science Operations, and it provides support to ESDIS Ground System Certification Testing for the EOS AM-1 and Landsat 7 missions. Release B also provides archive and distribution services for the Landsat 7 mission. Releases C & D provide evolutionary enhancements to the ECS services provided in the earlier Releases.

This document reflects the technical baseline maintained by the ECS Configuration Control Board in accordance with ECS technical direction (see Section 2.2).

1.3 Purpose

This document is written to formalize the interpretation and general understanding of the interfaces between ECS and TSDIS. The purpose of these interfaces is for ECS to archive TRMM science data products, distribute TRMM products to TSDIS for reprocessing, distribute ancillary data to TSDIS for processing and reprocessing, and distribute TRMM products to TSDIS users. This document provides clarification and elaboration of these interfaces to the extent necessary to assure hardware, software, and operational service compatibility within the end-to-end system.

This document provides a point of mutual control of external interface definitions for the ESDIS and TRMM Configuration Control Boards (CCBs).

1.4 Status and Schedule

This ICD describes the ECS-TSDIS interfaces that will be implemented in ECS Release A. No additional ECS-TSDIS interfaces are expected for ECS Release B.

This ICD is submitted as a EOSDIS Configuration Control Board (CCB) approval Code 1 document. At the Government's option, this document will be under full Government CCB control. Changes may be submitted at any time for consideration by Contractor and Government CCBs under the normal change process.

1.5 Organization

This document is organized in 5 sections plus appendices. Section 1 provides information regarding the identification, scope, purpose and objectives, and organization of this document. Section 2 contains information about documentation relevant to this ICD, including parent, applicable, and information documents. Section 3 provides an overview of the interfaces, with a brief description of the institutions involved. Section 4 provides an overview of the data exchange approaches. Section 5 defines the contents and formats for each data exchange between ECS and TSDIS, and a description of the TSDIS and ancillary data products involved. Appendix A contains a workoff plan for TBRs, TBDs, and TBSs. Acronyms and abbreviations are included in Appendix AB.

2. Related Documentation

2.1 Parent Documents

The following documents are the parents from which this document's scope and content is derived.

193-208-SE1-001	Methodology for Definition of External Interfaces for the ECS Project
301-CD-002-003	System Implementation Plan for the ECS Project
423-10-01-1	Goddard Space Flight Center, Earth Science Data and Information System (ESDIS) Level 2 Requirements EOSDIS Core System (ECS), Volume 1
423-10-04	Goddard Space Flight Center, Memorandum of Understanding Between the Tropical Rainfall Measuring Mission (TRMM) Project and the EOS Ground System and Operations Project (GSOP) for Science Data Archive and Distribution Support
423-41-01	Goddard Space Flight Center, EOSDIS Core System (ECS) Statement of Work
423-41-02	Goddard Space Flight Center, Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System
505-10-20	Goddard Space Flight Center, System Interface Control Plan for the Earth Science and Data Information System (ESDIS) Project
505-41-14	Goddard Space Flight Center, Interface Requirements Document Between the Earth Observing System Data and Information System (EOSDIS) and the Tropical Rainfall Measuring Mission (TRMM) Ground System
TRMM 490-003	Goddard Space Flight Center, Tropical Rainfall Measuring Mission (TRMM) System Specification -- Ground Segment
TSDIS-1994-REQ-00026	Goddard Space Flight Center, TSDIS Requirements Document, Revision 3

2.2 Applicable Documents

The following documents are referenced herein and are directly applicable to this document. In the event of conflict between any of these documents and this document, this document shall take precedence.

311-CD-002-004	Science Data Processing Segment (SDPS) Database Design and Database Schema Specifications for the ECS Project
175-WP-001-001	HDF-EOS Primer for Version 1 EOSDIS, White Paper for the ECS Project
210-TP-001-006	Technical Baseline for the ECS Project, 2/14/96
none	Goddard Space Flight Center, ECS Technical Direction No. 11, "PDR Technical Baseline," 12/6/94
TRMM-490-137	Goddard Space Flight Center, Tropical Rainfall Measuring Mission (TRMM) Telemetry and Command Handbook
TSDIS P-200	Goddard Space Flight Center, The Tropical Rainfall Measuring Mission Science Data and Information System (TSDIS) Requirements Document
TSDIS P-907	Goddard Space Flight Center, Interface Control Specification Between the Tropical Rainfall Measuring Mission (TSDIS) and the TSU, Volume 3: File Specifications for TSDIS Products - Level 1
TSDIS P-907	Goddard Space Flight Center, Interface Control Specification Between the Tropical Rainfall Measuring Mission (TSDIS) and the TSU, Volume 4: File Specifications for TSDIS Products - Level 2 and Level 3
TSDIS-1992-REQ-00	Goddard Space Flight Center, TRMM Science Requirements
510-203.103	Goddard Space Flight Center, Interface Control Document Between the Sensor Data Processing Facility (SDPF) and the Tropical Rainfall Measuring Mission (TRMM) Consumers
540 - 032	Goddard Space Flight Center, EBnet - Distributed Active Archive Center (DAAC) Interface Control Document (ICD)
540 - 047	Goddard Space Flight Center, EBnet - TRMM Science Data and Information System (TSDIS) Interface Control Document (ICD)
ON 388	U.S. Department of Commerce; National Oceanic and Atmospheric Administration (NOAA) Office Note 388; Unreviewed manuscript: The WMO Format for the Storage of Weather Product Messages in Gridded Binary Form (GRid In Binary [GRIB] data format)

CCSDS 301.0-B-2	Consultative Committee for Space Data Systems (CCSDS) Recommendation for Space Data System Standards: Time Code Formats, Blue Book, Issue 2
CCSDS 620.0-B-2	Consultative Committee for Space Data Systems (CCSDS) Recommendation for Space Data System Standards: Standard Formatted Data Units -- Structure and Construction Rules, Blue Book
CCSDS 641.0-B-1	Consultative Committee for Space Data Systems (CCSDS), Recommendation for Space Data System Standards: Parameter Value Language Specification (CCSD0006), Blue Book
RFC 791	Internet Protocol, J. Postel (<i>WWW access:</i> <i>gopher://ds.internic.net:70/</i>)
RFC 793	Transmission Control Protocol, J. Postel (<i>WWW access:</i> <i>gopher://ds.internic.net:70/</i>)
RFC 821	Simple Mail Transfer Protocol (SMTP), J. Postel (<i>WWW access:</i> <i>gopher://ds.internic.net:70/</i>)
RFC 822	Standard for the Format of Advanced Research Projects Agency (ARPA) Internet Text Messages, D. Crocker (<i>WWW access:</i> <i>gopher://ds.internic.net:70/</i>)
RFC 959	File Transfer Protocol, Internet Standards, J. Postel, J. Reynolds (<i>WWW access: gopher://ds.internic.net:70/</i>)
RFC 1157	A Simple Network Management Protocol (SNMP), J. Case, M. Fedor, M. Schoffstall, J. Davin (<i>WWW access:</i> <i>gopher://ds.internic.net:70/</i>)
RFC 1510	The Kerberos Network Authentication Service (V5), J. Kohl and B. Neuman (<i>WWW access: gopher://ds.internic.net:70/</i>)
none	HyperText Markup Language Specification Version 3.0, Internet Draft, D. Raggett
none	HyperText Transfer Protocol Version 1.0, Internet Draft, T. Berners- Lee, R. Fielding, H. Frystyk
none	General Sciences Corporation, White Paper, Tropical Rainfall Measuring Mission Science Data and Information System Data Compression Study for TSDIS

2.3 Information Documents

The following documents, although not directly applicable, amplify or clarify the information presented in this document, but are not binding.

194-201-SE1-001	Systems Engineering Plan for the ECS Project
194-202-SE1-001	Standards and Procedures for the ECS Project
490-010	Goddard Space Flight Center, TRMM Project Data Management Plan
500-135	Goddard Space Flight Center, Detailed Mission Requirements (DMR-2) for TRMM
553-FDD-91/028	Goddard Space Flight Center, Flight Dynamics Division (FDD) Interface Control Document for Generic Data Product Formats
TSDIS-P800	Goddard Space Flight Center, TRMM Science Data and Information System (TSDIS) Operations Concept
TSDIS-P402	Goddard Space Flight Center, TSDIS Segment Operations Scenarios
TSDIS P-403	Goddard Space Flight Center, TSDIS Software Design Specification

3. Interface Overview

TSDIS and ECS work together to provide support for the Visible and Infrared Scanner (VIRS), TRMM Microwave Imager (TMI), and Precipitation Radar (PR) instruments flown on the TRMM observatory, and corresponding Ground Validation (GV) data. The ECS components involved in this interface reside at and are operated by the Goddard Space Flight Center (GSFC) Distributed Active Archive Center (DAAC). This support includes science data archive and distribution.

TRMM is a Mission to Planet Earth mission designed to advance our understanding of total rainfall and to determine the rate of rainfall and the total rainfall occurring over the tropics and subtropics (between +35 and -35 degrees latitude). TRMM is also designed for the measurement and analysis of the Earth's radiant energy budget and lightning. The mission is a joint venture between National Aeronautics and Space Administration (NASA) and the National Space Development Agency of Japan (NASDA). The TRMM observatory is scheduled to be launched in August 1997.

TSDIS, or TRMM Science Data and Information System, is located at GSFC and houses the TRMM Science Data Operations Center (SDOC) and the Science Operations Control Center (SOCC). TSDIS processes PR, TMI, VIRS, and GV data to generate various levels of standard data products. The TSDIS-generated science data products are made available to the TSDIS Science Users (TSUs) (algorithm developers, instrument scientists, and quality control scientists) through Remote Science Terminals (RSTs) and via ECS. In addition, these standard data products are transferred from TSDIS to ECS for archive and distribution by ECS, and for later retrieval by TSDIS for reprocessing. TSDIS also has the capability to function as a proxy to request data from ECS for the TSUs, check on the status of the data requests, and cancel the data requests; ECS provides the requested data directly to the TSUs. All TSUs are registered users of ECS.

The GSFC DAAC supports research in the discipline areas of the upper atmosphere, atmospheric dynamics, global biosphere, and geophysics. The ECS components of the GSFC ECS DAAC has responsibility for archive and distribution of TMI, PR, and VIRS data products, combined products which include PR and/or TMI data and other data, GV data products, and ancillary data.

Figure 3-1 is a high-level illustration of these interfaces.

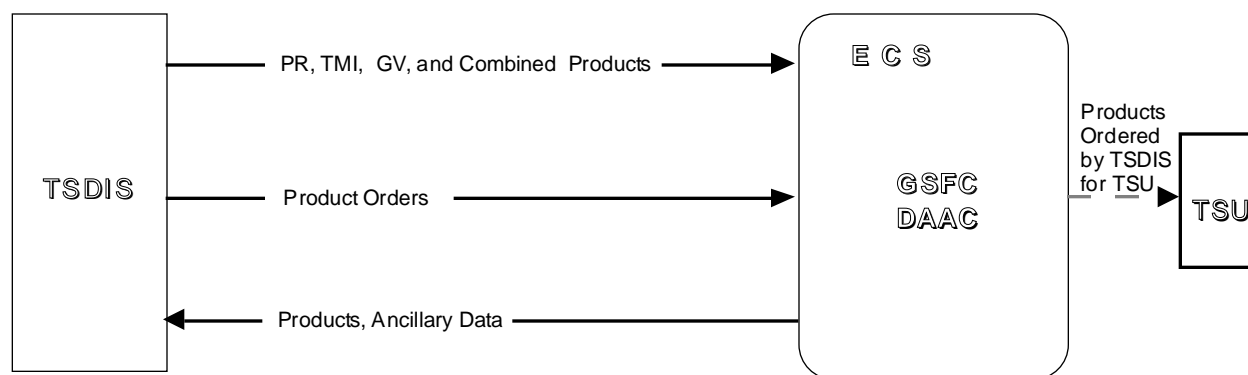


Figure 3-1. ECS/TSDIS Interface Overview

4. Data Exchange Framework

Section 4 defines the data exchange framework for the network interface, message flows, and file transfers between ECS and TSDIS. Section 4.1 provides an overview of the network topology, e-mail and HTML interfaces, file transfer protocol, ECS TSDIS Gateway interface, and security considerations. Section 4.2 discusses the ECS TSDIS Gateway interface requirements and control messages. Section 4.3 introduces the handshake control messages involved in the data exchanges and shows the various sequences in which they are used. Section 4.4 provides the format and content of the handshake control messages.

4.1 ECS-TSDIS Network Topology

4.1.1 Network and Transport Protocol

The network protocol used for TSDIS - ECS communication is the Internet Protocol (IP), specified in RFC 791. The network layer provides the transparent transfer of data between transport entities. IP addresses for the network nodes and data hosts for this interface are determined prior to installation at the facilities.

The transport protocol used for TSDIS - ECS communication is the Transmission Control Protocol (TCP), providing reliable delivery of data. TCP is specified in RFC 793.

4.1.2 Physical Network Topology

The physical network interface between TSDIS and ECS is provided by the EOSDIS Backbone Network (EBnet). Details relating to the physical topology are outlined in each organization's respective ICD with EBnet. The ECS - EBnet interface is specified in the EBnet Distributed Active Archive Center (DAAC) ICD. The TSDIS - EBnet interface is specified in the EBnet - TRMM Science Data and Information System (TSDIS) ICD.

4.1.3 E-mail Interface

ECS notifies TSUs of data availability of an order forwarded to ECS by TSDIS through Internet e-mail messages. E-mail is sent using the Simple Mail Transfer Protocol (SMTP), documented in RFC 821 and RFC 822.

4.1.4 HyperText Markup Language (HTML) and HyperText Transfer Protocol

HyperText Markup Language (HTML) is a simple markup language used to create hypertext documents that are portable from one platform to another. HTML protocols support generation of request forms used for interactive network ingest of document and guide data. The protocols for HTML are defined in HyperText Markup Language Specification Version 3.0. HTML, Version 3.0, is backwards compatible with HTML 2.0.

The HyperText Transfer Protocol (HTTP) is an application-level protocol used to access/transfer data created using the HTML. HTTP is used by TSDIS to access the ECS document and guide server for submitting documents and supporting metadata to the ECS archive. The basic version of HTTP is defined in the HyperText Transfer Protocol, Version 1.0, Internet-Draft. This document also defines status codes, which can include error information, that are returned as a result of transferring information via HTTP.

4.1.5 File Transfer

All file transfers between ECS and TSDIS are conducted through the use of the Kerberos File Transfer Protocol (kftp) version fully compatible with Version 5.5 which is public domain software. Standard File Transfer Protocol (ftp), as described in RFC 959, is an Internet standard for file transfers that supports retrieval of files from a remote server, with security provided by the requirement of a User ID and password. Kerberos Version 5 (which includes 5.5) is described in RFC 1510 and is a security protocol that can be applied to any network application. Kftp provides the same functionality as standard ftp but has an added layer for Kerberos authentication. Kftp data transfer between TSDIS and ECS is not encrypted. However, the Kerberos ticket for authentication is encrypted and is valid for 8 hours. Both ECS and TSDIS must host kerberized client and server software (kftp); ECS hosts the required security server.

All kftp data exchanges between ECS and TSDIS are automated and pulled by the consumer system (Computer Based Interface [CBI] Get), using "get" or "mget" commands. A "get" command is used to transfer one file, while an "mget" command is used to transfer multiple files.

File transfers from ECS to the TSUs are conducted by the TSUs (usually not automated) using the standard ftp (or kftp) "get" or "mget" commands. ECS cannot guarantee protection of these files from unauthorized read access without strong authentication (i.e., kftp). ECS and TSUs must both host ftp software for this interface.

TSDIS and ECS kftp daemons and ECS ftp daemons may be resident on several different servers. Files are obtained from one of these workstations in each kftp or ftp session.

User IDs and passwords are required for each ftp login by TSUs to ECS and are maintained by ECS. User IDs and passwords are needed for kftp connections (unless the user is already logged into kerberos) and are maintained by ECS. It is recommended that User IDs and/or passwords be changed, via the DAAC administrator, periodically (on the order of every 6 months) or whenever a system compromise is suspected.

4.1.6 Gateway Interface

All message interactions between TSDIS and ECS are done through TCP/IP connections between the ECS TSDIS Gateway and TSDIS. These message interactions are kerberized using the Kerberos Version 5.5 (or fully compatible version) software application, available in the public domain, and are in network byte order. ECS translates the TSDIS message protocol into ECS protocols. For connections initiated by TSDIS, a TSDIS client communicates with an ECS server; for connections initiated by ECS, an ECS client communicates with a TSDIS server.

Kerberos messaging provides an added layer of security, required by ECS, through Kerberos authentication. ECS and TSDIS must both host kerberized client and server software for interacting with the ECS TSDIS Gateway. ECS hosts the required security server. The NASA36 time/date service is used for synchronization of the TSDIS and ECS Kerberos applications.

Message and password encryption levels are indicated in the start session message (Table 4-2). Kerberos tickets are encrypted and valid for 8 hours.

4.1.7 Other Security Considerations

Only TSDIS users (TSUs and designated TSDIS personnel) are authorized to access or query the TSDIS data from launch through the first 6 months after the TRMM mission instrument checkout phase. ECS enforces this restricted access to TSDIS data through the Access Control List (ACL) mechanism, which consists of Unix-like group and/or user permissions defined and created for the TSDIS data and maintained in a database or an ASCII file by the ECS GSFC DAAC administrator. Through this mechanism, access permissions (e.g., read, insert, delete, and execute) are granted to a TSDIS defined user list for this time period. After this time period, data access can be unrestricted by the ECS GSFC DAAC administrator upon TSDIS request. However, successful enforcement of this restriction by ECS is limited by the TSDIS requirement to use protocol that lacks strong authentication to support access to the data by TSUs. The Clouds and Earth's Radiant Energy System (CERES) (an ECS instrument also flown on the TRMM spacecraft) science team is included in this access list because it uses TSDIS data as part of the CERES data processing. TSDIS TSUs are allowed to access the data, ordered for them by TSDIS, via ftp based on User ID and password. TSDIS and the TSUs have determined that the maintenance of confidential ftp User IDs and passwords (sent in plain text on the network) provides sufficient security for their data distribution needs.

4.2 ECS TSDIS Gateway Interface Details

The ECS Gateway interface with TSDIS involves a set of kerberized control messages, which are needed to support the Gateway functions. The messages are defined in Section 4.2.1, and the suggested Kerberos 5.5 software calling sequence for each direction of the interface are described in Sections 4.2.2 and 4.2.3.

4.2.1 Gateway Control Messages

TSDIS interaction with ECS Gateway requires a set of control messages for initial handshaking, protocol selection/setting, termination of session, and error handling. These ECS Gateway control messages are defined in Tables 4-1 through 4-5.

Table 4-1. Gateway Control

Message Name	Purpose	Description	Sender
Start Session	Session Authentication	TSDIS sends this to the ECS Gateway at the beginning of a session initiated by TSDIS to provide parameters for authentication by ECS	TSDIS
Close Session	Session Termination	TSDIS Notifies ECS Gateway of intent to terminate the connection	TSDIS
Start Session Acknowledgment	Response to Session Authentication	ECS Gateway sends this to TSDIS to report either an authentication failure or an authentication success	ECS
Gateway Error Message	Error Reporting	ECS Gateway reports errors in message flow to TSDIS	ECS

Table 4-2. Start Session Message Definition

Field	Description	Type (Length in Bytes)	Value
Message Type	Type of Message (Gateway Control Message)	Integer (1)	0
Message Length	Length of Message in Bytes	Integer (3)	288
Enumerated Type	Type of Gateway Control Message (Start Session = 0)	Integer (4)	0
External Interface ID	TSDIS Identifier	Integer (4)	1
Password Encryption Level	Level of encryption needed for password	Integer (4)	0 = No authentication 1 = Safe 2 = Private (1 for TSDIS)
Message Encryption Level	Level of encryption for all subsequent messages	Integer (4)	0 = No authentication 1 = Safe 2 = Private (1 for TSDIS)
Encryption Method	Method of encryption is kerberos	Integer (4)	0
User ID	Ktext block with null terminated User Name (for encryption) (see Note)	Integer (< 100)	ECS-assigned user ID
Password	Ktext block with null terminated Password (for encryption) (see Note)	Integer (< 100)	ECS-assigned Password
Spares	Padding for future use	64 bytes	zero filled

Note: "ktext" is a C structure, declared in the Kerberos header files, containing arbitrary data along with Kerberos-specific attachments for security

Table 4-3. Start Session Acknowledgment Message Definition

Field	Description	Type (Length in Bytes)	Value
Message Type	Type of Message (Gateway Control Message)	Integer (1)	0
Message Length	Length of Message in Bytes	Integer (3)	8
Enumerated Type	Type of Gateway Control Message Authentication Failure is 5; Authentication Success is 6	Integer (4)	5 or 6

Table 4-4. Close Session Message Definition

Field	Description	Type (Length in Bytes)	Value
Message Type	Type of Message (Gateway Control Message)	Integer (1)	0
Message Length	Length of Message in Bytes	Integer (3)	76
Enumerated Type	Type of Gateway Control Message (Close Session = 2)	Integer (4)	2
Socket Notification Flag	Indicates whether ECS gateway socket interface should be notified of closure of session 1 is true; 0 is false	Integer (4)	0 or 1
ECS Internal Server Notification Flag	Indicates whether ECS internal server should be notified (with same message) of session closure; 1 is true; 0 is false	Integer (4)	0 or 1 (usually 1 for TSDIS)

Table 4-5. Gateway Error Message Definition

Field	Description	Type (Length in Bytes)	Value
Message Type	Type of Message (Gateway Control Message)	Integer (1)	0
Message Length	Length of Message in Bytes	Integer (3)	12
Enumerated Type	Type of Gateway Control Message (Gateway Error = 7)	Integer (4)	7
Error Type -	One of the following Types of Gateway Errors:	Integer (4)	
Unknown Control Message	- Unknown control message was received		0
Unknown Message Type	- Unknown message type was received - ignored		1
Message Parse Error	- Message could not be parsed - probably never used		2
Control Message Parse Error	- A control message could not be parsed - ignored		3
Invalid Sequence	- Unexpected message - ignored		4
Kerberos Error	- Kerberos error occurred		5
Unknown Fatal Error	- ignored		6
Unable to Contact Servers	- Unrecoverable error occurred - gateway closing		7
Generic Error	- Communication with ECS internal server		8
	- Everything else		

4.2.2 TSDIS Establishes the Connection

The following are suggested steps and Kerberos calling sequences for use by TSDIS in establishing a connection with the ECS Gateway and preparing to send the handshake control messages described in Sections 4.3 and 4.4. ECS has provided wrapper functions to encapsulate all of the Kerberos calls listed below. They are listed here for the sake of completeness.

1. Acquire the Kerberos tickets through "kinit" by supplying the user name and password or using a keytab file.
2. Open a socket connection to a well known port and IP address.
3. Write the Start Session Message to the socket.
4. Kerberos handshake
 - a. Invokes "krb5_init_context" and "krb5_init_ets" to initialize the context and error table.
 - b. Get the full hostname, using "gethostname", and convert from capital letters to lower case letters.
 - c. Get the gateway socket address, using "getpeername", and the TSDIS self address using "getsockname".
 - d. Get a ticket to communicate with the ECS Gateway (invoke "krb5_cc_default" to set the cache).
 - e. Invoke "krb5_mk_req" to format the KRB_AP_REQ message (specify the server name. This call then checks the cache first to see if a ticket is available to talk to the Gateway. Failing that, it acquires a ticket from the security server).
 - f. Send the above formatted KRB_AP_REQ message to the ECS Gateway (by writing it to the socket).
 - g. Invoke "krb5_auth_con_setports" and "krb5_auth_con_setaddrs" to set self and remote addresses in the auth context.
 - h. Invoke "krb5_gen_portaddr" to generate a freshly allocated address with the type ADDRTYPE_ADDRPORT.
 - i. Invoke "krb5_gen_replay_name" to generate replay cache tag.
 - j. Invoke "krb5_rc_resolve_type" to attach the default cache type to the replay cache.
 - k. Invoke "krb5_rc_resolve" to initialize private data attached to the replay cache.
 - l. Call "krb5_rc_recover" and "krb5_rc_initialize" to recover or create/refresh the replay cache.
 - m. Invoke "krb5_auth_con_setrcache" to set authorization context replay cache.

- n. Encrypt the password with the “krb5_mk_priv” call.
5. Send the encrypted password.
6. Receive the Start Session Acknowledgment from the ECS Gateway. If it fails, the ECS Gateway closes the connection and exits the process. Further interaction assumes that the authentication has succeeded.
7. Send an unencrypted handshake control message.
8. Receive the response message from the ECS Gateway.
9. Continue sending a handshake control message and receiving a response as needed; when finished, send the Close Session message.

4.2.3 ECS Establishes the Connection

The following are suggested steps and Kerberos calling sequences for use by the ECS Gateway in establishing a connection with TSDIS and preparing to send the handshake control messages described in Sections 4.3 and 4.4.

- 1) Receive a handshake control message from an ECS subsystem, to be forwarded to TSDIS, through a synchronous call which waits for the reply that is in step 6 below.
- 2) Open a socket connection to the well known port on the TSDIS host IP address. (Data integrity is mandated when ECS opens the connection to TSDIS. No messages are sent to TSDIS to indicate this.)
- 3) Perform the Kerberos handshaking for self-authentication. Please see step 4 in Section 4.2.2 for details of the Kerberos handshaking.
- 4) Write the handshake control message from the ECS subsystem onto the TSDIS socket.
- 5) Read the returned response and close the socket.
- 6) Return the read information as a reply to the call received in step 1.

4.3 Handshake Control Messages and File Transfer Sequences

Initiation and completion of data transfer requires automated transmission of handshake control messages, or domain messages, between ECS and TSDIS. These messages, which are based on the Sensor Data Processing Facility (SDPF) CBI Get Protocol, are transferred between TSDIS and ECS via a TCP/IP connection between TSDIS and the ECS Gateway, as shown in Figures 4-1 through 4-6. The pairs of vertical lines indicate the TSDIS and ECS sides of the interface and define separate sessions, each involving either a TCP/IP socket connection and termination or a kftp connection and termination. The originator of the connection generally terminates (closes) the connection though either party may terminate a connection if the other party has been

inactive after an operations tunable amount of time. Table 4-6 lists the messages involved before and after an electronic file transfer. These messages are defined in Sections 4.4.1 through 4.4.14.

Table 4-6. Handshake Control Messages

Message Name	Purpose	Description	Sender
Data Availability Notice (DAN)	Notification of Data Ready for Transfer	System with data notifies Consumer system that the data are staged and ready for transfer.	TSDIS and ECS
Data Availability Acknowledgment (DAA)	DAN Handshake	Consumer system acknowledges that the DAN has been received, and notifies of any DAN errors	TSDIS and ECS
Data Delivery Notice (DDN)	Notification of Data Transfer	Consumer system notifies that data has been transferred, ingested and archived; includes identification of data retrieval success and/or problems	TSDIS and ECS
Data Delivery Acknowledgment (DDA)	DDN Handshake	System with data notifies Consumer system that the DDN has been received, which indicates that the data can be deleted from the staging area	TSDIS and ECS
Data Request	Request data	TSDIS requests data from the ECS archive	TSDIS
Data Request Acknowledgment	Data Request Handshake	ECS acknowledges to TSDIS that the Data Request has been received and is or is not valid	ECS
Data Subscription Request	Request Subscription	TSDIS subscribes to receive new data when it is received in the ECS archive	TSDIS
Data Subscription Acknowledgment	Data Subscription Handshake	ECS acknowledges to TSDIS that the Data Subscription has been received, implemented, or is not valid	ECS
Product Order Status Request	Request status	TSDIS requests the status of a Data Request or Data Subscription	TSDIS
Product Order Status	Status	ECS provides TSDIS with the status of a Data Request or Data Subscription	ECS
Product Order Cancellation Request	Cancellation	TSDIS requests cancellation of a Data Request or Data Subscription	TSDIS
Product Order Cancellation	Cancellation Notification	ECS notifies TSDIS that the Data Request or Data Subscription has been cancelled.	ECS
Metadata Update Request	Update QA Metadata	TSDIS sends ECS updated QA metadata parameters after product QA	TSDIS
Metadata Update Acknowledgment	Metadata Update Notification	ECS notifies TSDIS that QA Metadata parameters have been updated	ECS

4.3.1 ECS Retrieves Data from TSDIS to Archive

The sequence of Gateway and handshake control messages, and file transfers needed for ECS to retrieve data from TSDIS is illustrated in Figure 4-1.

TSDIS opens the TCP/IP connection to the ECS Gateway and sends ECS a Start Session message. ECS returns a Start Session acknowledgment. After successful authentication, TSDIS then sends a Data Availability Notice (DAN) message to ECS, specifying the names of the data files, file sizes, file dates and times, number of files, and file locations for the files available for ECS to archive (see Tables 4-7 and 4-8 for the full DAN contents). ECS validates the DAN, and sends the corresponding handshake control message, the Data Availability Acknowledgment (DAA), which reports the disposition of the DAN.

It is possible to send more than one DAN within a TCP/IP session; however another DAN cannot be sent until the acknowledgment (DAA) is received for the previous DAN. Each DAN is distinguished from the others by the sequence number and processor identifier which created it. These parameters are included in the DAN message. After all DANs have been acknowledged, TSDIS closes the session by sending ECS a Close Session message, and terminates the connection.

When ready, ECS begins the kftp file transfer process, and transfers all the files in each error-free file group listed in the DAN. Each file is verified, by checking its name and size against DAN information; metadata is extracted; and the file transfer result is logged in the Data Delivery Notice (DDN). After all the files have been transferred, ingested, and archived or when all attempts have been exhausted, ECS opens a new TCP/IP connection and sends TSDIS a DDN to the same IP address that sent the DAN, notifying whether files were successfully archived and/or identifying errors associated with individual files for a particular DAN. Only complete file groups that are transferred without error are ingested and archived. TSDIS responds with the corresponding handshake control message, the Data Delivery Acknowledgment (DDA). ECS terminates the connection after all DDNs have been acknowledged by TSDIS. A DDA disposition returned by TSDIS of 2 indicates that TSDIS had problems processing the DDN through their system (i.e., database failure); ECS re-establishes the connection and resends the DDN an operations tunable amount of time later.

In the case of failure in file transfer and archive, due to an error in the DAN, TSDIS corrects the error and sends a new DAN. If there is a network failure during or before file transfer, ECS retries an operations-tunable number of times. If the retry is successful, no retransmission of the DAN is required from TSDIS. If unsuccessful after all retries, an alert is sent to the ECS operator. The ECS operator interfaces with the TSDIS operator for resubmittal of the DAN. ECS is not required to ingest data from TSDIS via physical media, since TSDIS is capable of storing 3 days worth of data.

Files that have been successfully archived within ECS are eligible for deletion at TSDIS.

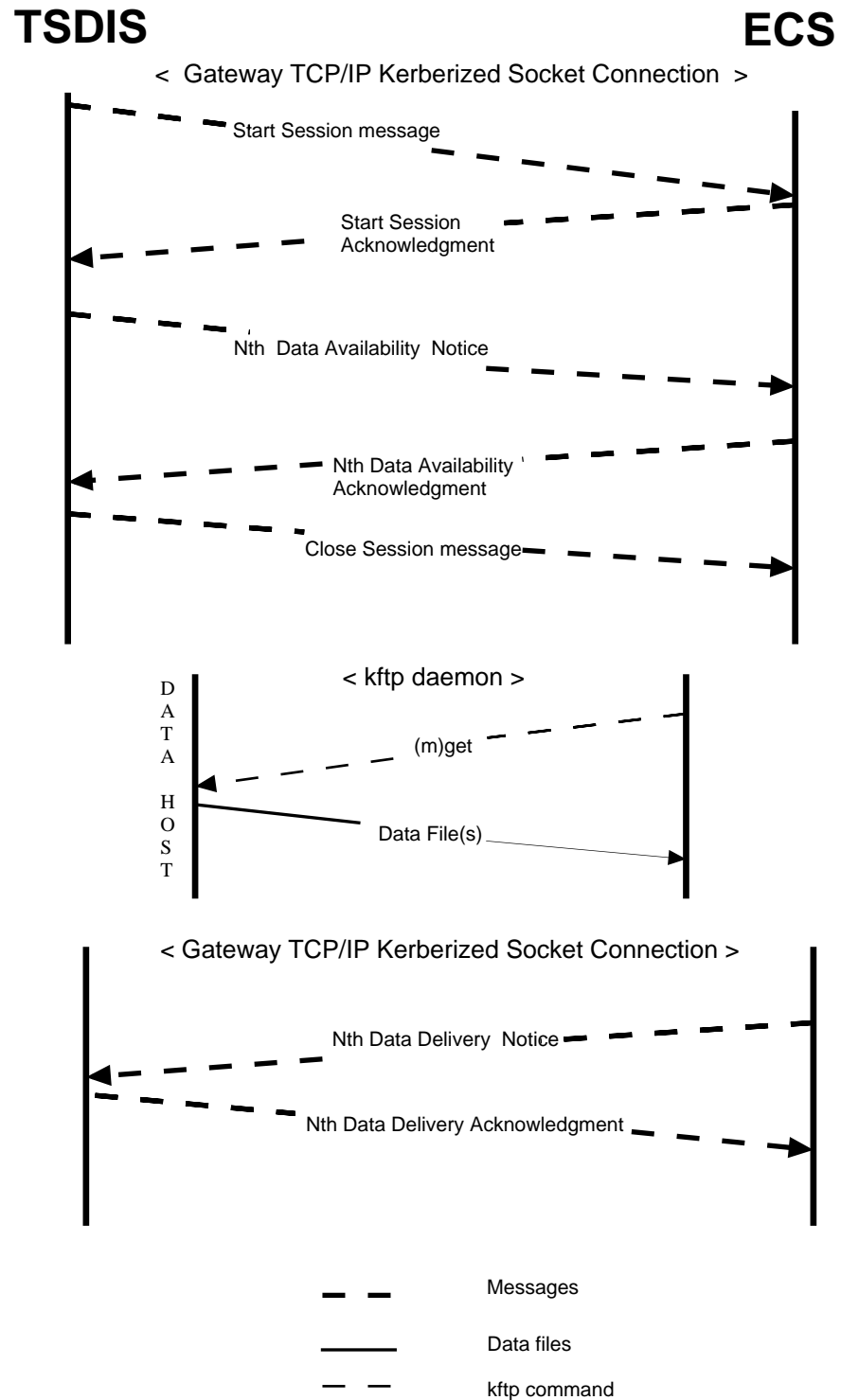


Figure 4-1. ECS Retrieves Data from TSDIS

4.3.2 TSDIS Requests/Retrieves Data from ECS

The sequence of Gateway and handshake control messages, and file transfers needed for TSDIS to request and retrieve data from ECS is illustrated in Figure 4-2. Data are ordered by either the Data Request or the Data Subscription, which are described in more detail in Sections 4.4.5 through 4.4.8. Both scenarios are described below.

4.3.2.1 Data Request Scenario

TSDIS opens the TCP/IP connection to the ECS Gateway, and sends the Start Session message. ECS returns the Start Session Acknowledgment message. After successful authentication, TSDIS sends a Data Request message to ECS, ordering the data needed for reprocessing. ECS checks the archive for the existence of the requested files and checks for available disk space on the file server. After receipt of the Data Request, ECS sends the Data Request Acknowledgment (DRA) message, which reports the disposition of the Data Request. If the disposition is not successful, then ECS does not stage the data; instead, TSDIS resubmits a valid Data Request. If the disposition is successful, ECS retrieves all the requested data from the archive and places it on the file server in a timely manner after sending the DRA message to TSDIS. The actual turnaround times depend on the volume of data requested and the network load. TSDIS may send another Data Request after receiving a DRA; TSDIS closes the session, using the Close Session message, after receiving the last DRA. Refer to Sections 4.4.5 and 4.4.6 for more information on the Data Request and DRA messages.

TSDIS may send a Product Order Status Request (Section 4.4.9) message any time after receiving the DRA (TBR). When the data have been staged, ECS opens a TCP/IP connection to the same IP address from which the Data Request was sent and sends a DAN message to TSDIS. The DAN specifies the number of files, file sizes, file names and directory paths for the files available for TSDIS to kftp from the ECS file server (see Tables 4-7 and 4-8 for the full DAN contents). More than one DAN can be sent for each Data Request. If none of the data can be acquired, the DAN reports a file count of 0. TSDIS sends the corresponding handshake control message, the Data Availability Acknowledgment (DAA), which reports the disposition of the DAN. A non-zero disposition indicates where TSDIS processing of the DAN ended. ECS evaluates the disposition; the ECS operator interfaces with the TSDIS operator to complete the Data Request, as appropriate.

It is possible to send more than one DAN within a TCP/IP session; however another DAN cannot be sent until the acknowledgment (DAA) is received for the previous DAN. Each DAN is distinguished from the others by the sequence number and processor identifier which created it. These parameters are included in the DAN message. ECS terminates the connection after sending all available DANs and receiving the corresponding acknowledgments.

When ready, TSDIS begins the kftp file transfer process and transfers all the files in each file group listed in the DAN. Each file is checked against DAN information, and the file transfer result is logged for the Data Delivery Notice (DDN). After all the files have been transferred successfully or transfer attempts have been exhausted, TSDIS opens a new TCP/IP connection with ECS, sending the Start Session message and receiving the acknowledgment from ECS.

After successful authentication, TSDIS sends ECS a DDN notifying whether files were successfully retrieved and validated and/or identifying errors associated with individual files for a particular DAN. TSDIS ingests only files that are transferred without error. ECS responds with the corresponding handshake control message, the Data Delivery Acknowledgment (DDA). If TSDIS sends a long DDN indicating that some files could not be ingested, ECS sends a new DAN for just those files. One or more sets of DDN and DDA messages may be exchanged during the session. TSDIS then closes the session using the Close Session message and terminates the connection.

Files are eligible for deletion from the ECS file server after the expiration time parameter specified in the DAN by ECS, or after the files have been successfully retrieved (whichever is earlier). If the file transfer cannot be completed before the expiration time, TSDIS is required to submit a new request for the data. The expiration time interval after the DAN is sent depends on the available space on the file server. A minimum time interval is set by the GSFC DAAC, and will be included in the DAAC-specific operations procedures in the DAAC Operators Manuals (DID 611).

In cases of problems in file transfers (kftp), data transfer attempts are repeated an operations tunable number of times. If there is a network failure during or before file transfer, TSDIS retries an operations-tunable number of times. If unsuccessful after all retries, an alert is sent to the TSDIS operator. The TSDIS operator interfaces with the ECS operator to verify that the interface is operational. ECS does not provide data to TSDIS via physical media.

4.3.2.2 Data Subscription Scenario

TSDIS sends a Data Subscription Request message to ECS for a standing order to receive predefined ancillary data as soon as ECS receives and archives it, at any time during the TRMM mission. TSDIS first establishes the TCP/IP connection with ECS, and is authenticated via the Start Session message. After receiving the Data Subscription Acknowledgment, TSDIS sends a Close Session message and terminates the connection.

When the ancillary data are inserted into the ECS archive, ECS opens a TCP/IP connection to a predefined TSDIS IP address and sends a DAN message. The rest of the scenario is the same as for a Data Request.

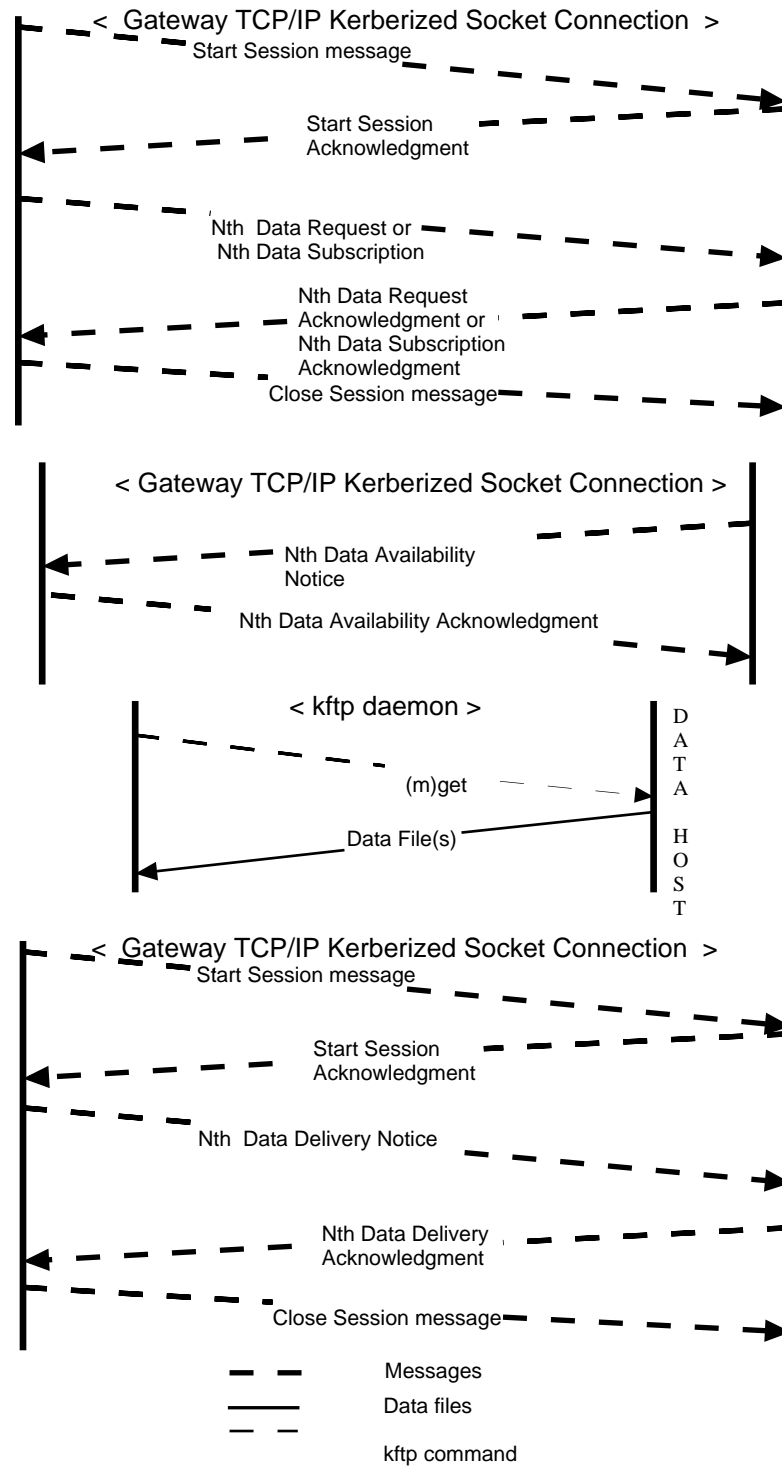
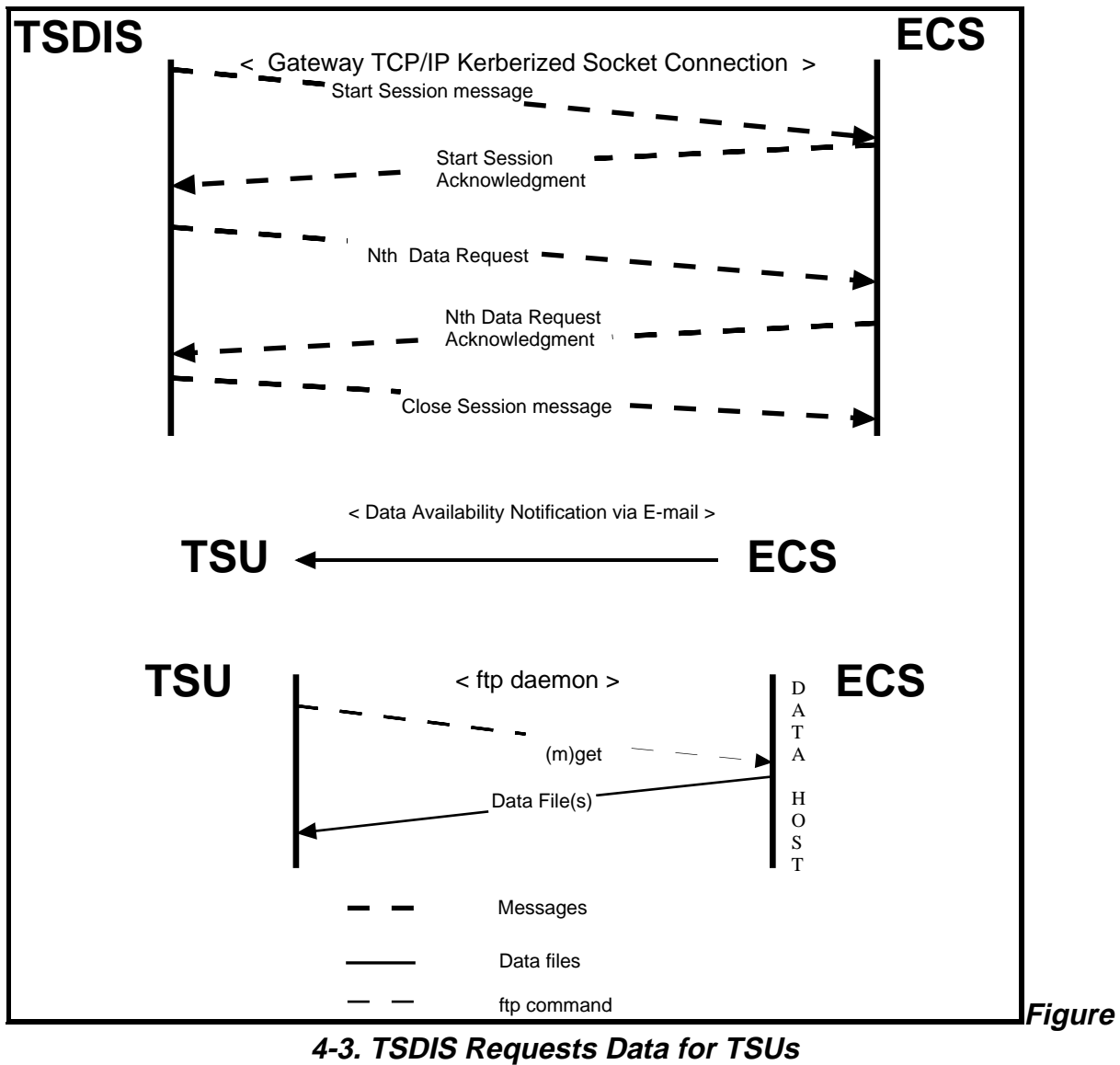
TSDIS**ECS**

Figure 4-2. TSDIS Requests/Retrieves Data from ECS4.3.3 TSDIS Orders Data from ECS for TSUs

The sequence of Gateway and handshake control messages and file transfers needed for TSUs to obtain data from ECS via TSDIS is illustrated in Figure 4-3.

TSDIS establishes a TCP/IP connection and sends the Start Session message; ECS returns the Start Session acknowledgment. After successful authentication, TSDIS sends a Data Request message to ECS to order the data on behalf of a TSDIS Science User (TSU). This request indicates how the data are to be delivered; either electronically (the TSU pulls the data from ECS, via ftp [or kftp], over the Internet) or via ECS standard 8 mm tape media (ECS puts the data on 8 mm tape and mails the tape to the TSU). ECS sends the corresponding handshake control message, the Data Request Acknowledgment (DRA), which reports the disposition of the Data Request. TSDIS may send another Data Request after receipt of a DRA. TSDIS sends a Close Session message and terminates the connection after receiving the last DRA expected. ECS then retrieves the requested data, if available, from the archive and places it on the file server or copies it to 8 mm tape. TSDIS may send a Product Order Status Request (Section 4.4.9) message any time after receiving the DRA. ECS sends Product Order Status (Section 4.4.10) messages to TSDIS in response to the Product Order Status Requests. ECS sends a human-readable notification via e-mail to the TSU when a Data Request has been filled or if there is an error filling the request (non-successful status). For an electronic delivery ECS sends the notification a few minutes (nominally) after receiving the Data Request. The notification for electronic delivery indicates to the TSU the location of the data and the expiration time. For 8 mm tape media delivery, ECS sends the e-mail notification indicating to the TSU that the tape has been mailed to the TSU facility (on the order of 24 hours after receiving the Data Request from TSDIS).

If delivery of the data to the TSU is requested to be done electronically, the TSU transfers all the files listed in the e-mail notification using ftp or kftp. Files are eligible for deletion from the ECS file server after the expiration time specified in the notification, or after the files have been successfully retrieved, whichever is earlier. If the file transfer cannot be completed before the expiration time, the TSU is required to submit a new order for the data. The expiration time interval after the notification is sent depends on the available space on the file server. A minimum time interval is set by the GSFC DAAC, and will be included in the DAAC-specific operations procedures in the DAAC Operators Manuals (DID 611).



4.3.4 TSDIS Requests Status of Product Orders

Figure 4-4 shows the sequence of Gateway and handshake control messages involved for TSDIS to check on the status of Data Requests or Data Subscriptions, either for itself or for TSUs. TSDIS sends a Product Order Status Request to ECS, in response to which ECS sends a Product Order Status.

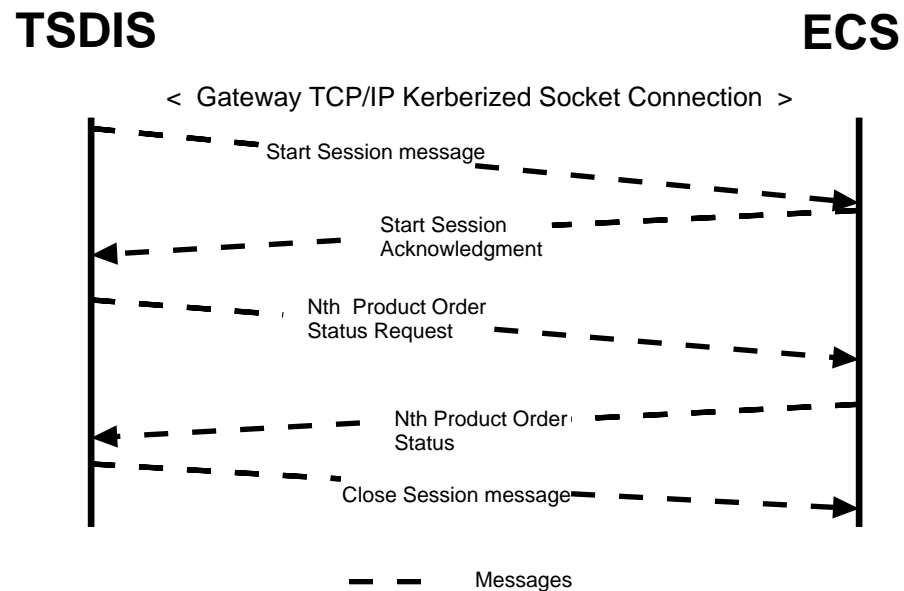


Figure 4-4. TSDIS Requests Status of Product Orders

4.3.5 TSDIS Cancels Product Orders

Figure 4-5 shows the sequence of Gateway and handshake control messages involved for TSDIS to cancel a Data Request or Subscription Request which is currently active at ECS. When TSDIS needs to cancel a Data Request or Data Subscription, it sends a Product Order Cancellation Request message to ECS. ECS then sends a Product Order Cancellation message.

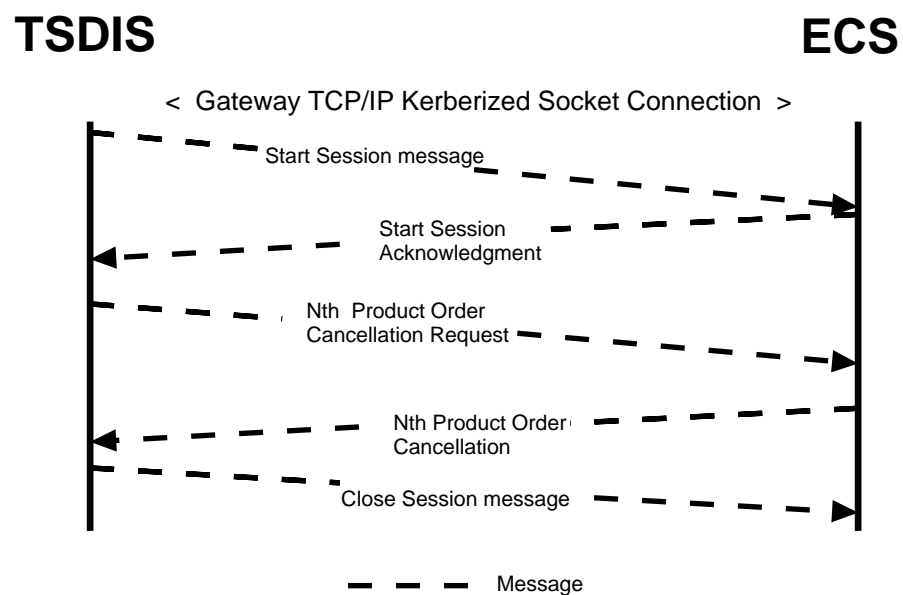


Figure 4-5. TSDIS Requests Product Order Cancellation

4.3.6 TSDIS Sends Updated Metadata

Figure 4-6 shows the sequence of Gateway and handshake control messages involved for TSDIS to send ECS updated metadata for products already in the archive. When TSDIS needs to send updated Quality Indicator metadata, it sends a Metadata Update Request message to ECS. ECS then sends a Metadata Update Acknowledgment message, which either states that the metadata have been successfully updated or it states the disposition of the Metadata Update Request message.

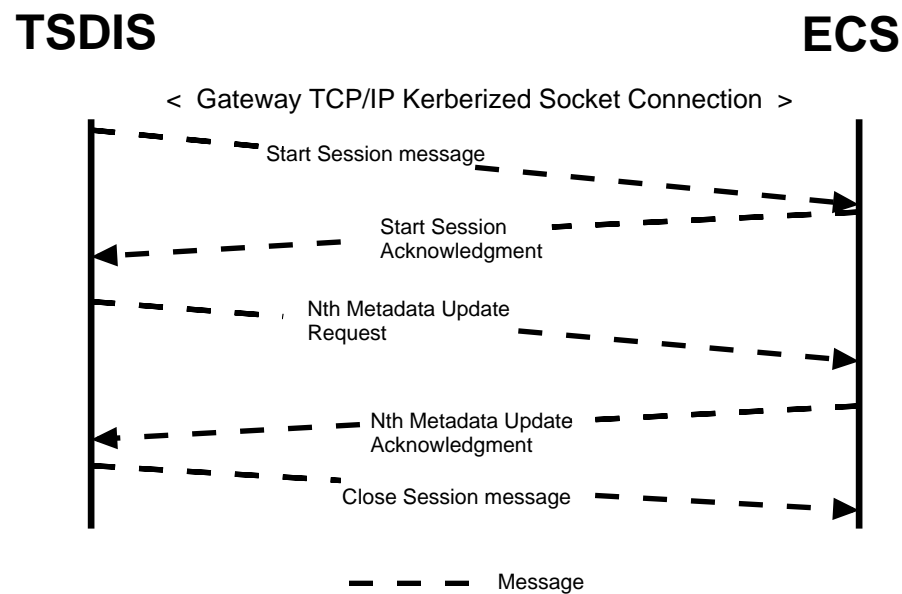


Figure 4-6. TSDIS Requests Metadata Update

4.4 Message Format and Contents Overview

The handshake control messages are identified in Table 4-6. The message formats contain both fixed and variable length strings. A zero byte (NULL character) is used as a field separator for variable length strings in the manner of the C programming language, except in the Parameter Value Language (PVL) as noted in Section 4.4.1. Field lengths are specified in terms of bytes, where a byte is equal to 8 bits. The specified field lengths do not include the null character used to terminate variable length strings. The Message Type and Message Length fields comprise the Message Header.

A control message is rejected when it contains errors or is sent in an inappropriate sequence. The message source receives notification of this rejection, via a control message from the message destination. Error conditions for each of the messages include out-of-bound parameter values, invalid parameter values, and missing parameter values (e.g., message type). In most cases, the message is corrected by the message source, and resent.

The message transfer scenario between TSDIS and ECS supports operator tunable parameters, which are included in the operations procedures for TSDIS and the ECS components of the GSFC DAAC, which are documented in the DAAC Operators Manuals (DID 611). Operator tunable parameters include:

- Time after which either system will close a connection if the other party has not sent any messages.
- Time between sending a DAN and the time the data will be deleted from the file server if it has not been retrieved. ECS guarantees data to be available on the file server for at least 48 hours.

4.4.1 Data Availability Notice (DAN)

A DAN message is sent by the system supplying the data (TSDIS or ECS processor) to the Consumer System (system that receives the data) to announce the availability of data for transfer. It specifies the parameters needed to identify what files are ready for pickup, their location, and how long they will be available in that location. The maximum message length allowed for a DAN sent between TSDIS and ECS is 1 megabyte (1,048,576 bytes). More than one DAN may be sent if needed.

Figure 4-7 shows the DAN message structure. Each DAN includes a Message Header, Exchange Data Unit (EDU) Label, a DAN Label and Parameter Value Language (PVL) Statements. The Message Header and labels are in a contiguous string, followed by the PVL. The labels and PVL statements are in Standard Formatted Data Unit (SFDU) format. (More information about SFDU and PVL can be found in the documents Consultative Committee for Space Data Systems (CCSDS), *Standard Formatted Data Units -- Structure and Construction Rules, Blue Book*, and Consultative Committee for Space Data Systems (CCSDS), *Parameter Value Language Specification (CCSD0006), Blue Book*.)

Table 4-7 contains the Message Header and labels; Table 4-8 specifies the required parameters in the DAN PVL and their values, for DANs from ECS to TSDIS (where the Consumer System is TSDIS) and from TSDIS to ECS (where the Consumer System is ECS).

The DAN PVL statements are ASCII strings, each string having at most 256 characters, in the form of: "Parameter = Value;". The semi-colon at the end of each statement serves as the field delimiter. No blank (white) spaces are allowed immediately before the semi-colon. A carriage return (\n) may be added after the semi-colon, for human readability, but is not required. The string values shown in Table 4-8 include pre-defined ASCII values indicated in the table by single quote marks, and a description or range of processor determined values without quotes. These quotes are not used in the actual messages. Processor determined values include ASCII alphanumerics, ASCII numerics, and International Standards Organization (ISO) times to be filled in with the proper values by the originating system's processor during DAN creation. (ISO format is described in Consultative Committee for Space Data Systems (CCSDS), Time Code Formats, Blue Book.) Comments in the actual PVL, if included, are enclosed in delimiters as follows: /*...comment...*/. (Note: Comments are not used within any control messages exchanged between TSDIS and ECS.) The combination of the DAN sequence number and originating system (processor identifier) parameters uniquely identify each DAN and provides the link between related DAN, DAA, DDN, DDA, and Data Request/Data Subscription control messages. The FILE_SPEC and FILE_GROUP objects are repeatable within a single DAN, for multiple files and/or file groups. The TOTAL_FILE_COUNT parameter indicates the number of files staged for retrieval. Sample PVL for DANs sent to or from TSDIS and ECS is shown in Figures 4-8 and 4-9.

DANs are validated to check that all required fields are present and that the format of the message is correct and consistent with the standards. DANs that adhere to the defined message standards shown in Tables 4-7 and 4-8 are accepted and processed. If an entire DAN is determined to be invalid (e.g. invalid DAN sequence number) as reflected in the corresponding short DAA, none of its file groups are processed and none of the files are transferred. If a DAN contains multiple file groups for which one or more file groups contain DAN validation errors, the DAN is rejected and not processed; a long DAA is returned describing the disposition of each file group with errors.

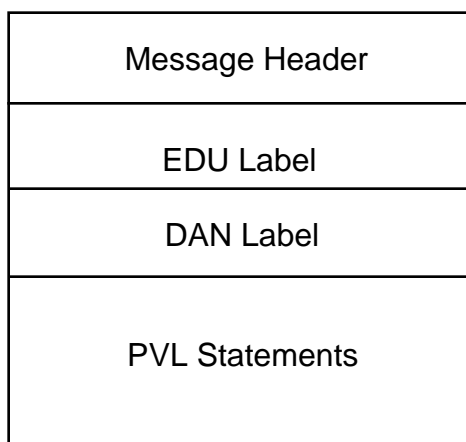


Figure 4-7. DAN Message Structure

Table 4-7. DAN Message Header, and EDU and DAN Labels

Field	Description	Type (Length in Bytes)	Value
Message Type	indicates DAN	Unsigned Integer (1)	1
Message Length	Length of Message in bytes	Unsigned Integer (3)	$\leq 1,048,576$
Exchange Data Unit Label	Not used	ASCII (20)	20 byte fill
DAN Label	Not used	ASCII (20)	20 byte fill

Table 4-8. Required DAN PVL Parameters (1 of 4)

Parameter	Description	Type / Format (Maximum Length in Bytes)	Consumer System	Value
ORIGINATING_SYSTEM	Originator of DAN	Variable String / ASCII (20)	TSDIS or ECS	TSDIS or ECS Processor Identifier (Note 1)
CONSUMER_SYSTEM	Destination of DAN	Variable String / ASCII (20)	TSDIS or ECS	ECS or TSDIS Processor Identifier (Note 1)
DAN_SEQ_NO	Sequence number assigned by originating system	Unsigned 32-bit Integer / ASCII (10)	TSDIS or ECS	$\leq 4.295 \times 10^9$
REQUEST_TYPE	Type of request which applies to this DAN	Variable String / ASCII (32)	TSDIS	'Subscription', 'Data Request'
ECS_ID	Identifier of corresponding Data Request or Data Subscription Request	Variable String / ASCII (20)	TSDIS	Unique ID in Data Request Acknowledgment or Data Subscription Acknowledgment
TOTAL_FILE_COUNT	Total number of files to transfer	Unsigned Integer / ASCII (4)	TSDIS or ECS	0 - 9999 (0 is valid in response to a TSDIS Data Request)

Note 1. Each processor must have a unique identifier.

Note 2. Size can vary up to 256 bytes total when DIRECTORY_ID is combined with FILE_ID.
Size limit excludes the null terminator.

Table 4-8. Required DAN PVL Parameters (2 of 4)

Parameter	Description	Type / Format (Maximum Length in Bytes)	Consumer System	Value
AGGREGATE_LENGTH	Total number of bytes to transfer (sum for all files)	Unsigned 64-bit Integer / ASCII (20)	TSDIS or ECS	$\leq 1.844 \times 10^{19}$
EXPIRATION_TIME	ISO Time for data deletion from originating system	Fixed String / ASCII (20)	TSDIS or ECS	GMT in the format: yyyy-mm-ddThh:mm:ssZ where T and Z are literals (operations tunable time after DAN sent)
OBJECT	Start of file group parameters (repeat for each group of files)	Fixed String / ASCII (10)	TSDIS or ECS	'FILE_GROUP'
DATA_TYPE	ECS Data Type	Variable String / ASCII (20)	TSDIS or ECS	Valid ECS Data Type, as listed in Tables 5-4 and 5-5
DATA_VERSION	Version of Data files	Unsigned Integer / ASCII (2)	TSDIS or ECS	1 through 99
NODE_NAME	Name of network node on which the file resides	Variable String / ASCII (64)	TSDIS or ECS	e.g. 'ecssrv1.gsfc.nasa.gov'

Table 4-8. Required DAN PVL Parameters (3 of 4)

Parameter	Description	Type / Format (Maximum Length in Bytes)	Consumer System	Value
OBJECT	Start of Detached SFDU Header File Object, if appropriate	Fixed String / ASCII (6)	ECS	'DP_CIO'
DIRECTORY_ID	File directory name (i.e., path name)	Variable String / ASCII (256) (Note 2)	ECS	e.g. /PR/Level1
FILE_ID	File name	Variable String / ASCII (256) (Note 2)	ECS	Detached SFDU header file name
FILE_TYPE	File Data Type	Variable String / ASCII (20)	ECS	'METADATA'
FILE_SIZE	Length of file in bytes	Unsigned 32-bit integer / ASCII (10)	ECS	$\leq 4.295 \times 10^9$
END_OBJECT	End Detached SFDU Header File Object, if appropriate	Fixed String / ASCII (6)	TSDIS or ECS	'DP_CIO'
OBJECT	Start of file parameters (repeat for each file)	Fixed String / ASCII (9)	TSDIS or ECS	'FILE_SPEC'
DIRECTORY_ID	File directory name (i.e., path name)	Variable String / ASCII (256) (Note 2)	TSDIS or ECS	e.g. /PR/Level1
FILE_ID	File name	Variable String / ASCII (256) (Note 2)	TSDIS or ECS	TSDIS Granule ID
FILE_TYPE	File Data Type	Variable String / ASCII (20)	TSDIS or ECS	'BROWSE', 'SCIENCE'

Table 4-8. Required DAN PVL Parameters (4 of 4)

Parameter	Description	Type / Format (Maximum Length in Bytes)	Consumer System	Value
FILE_SIZE	Length of file in bytes	Unsigned 32-bit Integer / ASCII (10)	TSDIS or ECS	$\leq 4.295 \times 10^9$
BEGINNING_DATE/TIME	ISO Start time of data in file as defined in the metadata	Fixed String / ASCII (20)	TSDIS or ECS	GMT in the format: yyyy-mm-ddThh:mm:ssZ where T and Z are literals
ENDING_DATE/TIME	ISO End time of data in file as defined in the metadata	Fixed String / ASCII (20)	TSDIS or ECS	GMT in the format: yyyy-mm-ddThh:mm:ssZ where T and Z are literals
END_OBJECT	End of file parameters (repeat for each file)	Fixed String / ASCII (9)	TSDIS or ECS	'FILE_SPEC'
END_OBJECT	End of file group (repeat for each file group)	Fixed String ASCII (10)	TSDIS or ECS	'FILE_GROUP'

```

ORIGINATING_SYSTEM = TSDIS1;
CONSUMER_SYSTEM = ECS_GSFC_1;
DAN_SEQ_NO = 5326;
TOTAL_FILE_COUNT = 3;
AGGREGATE_LENGTH = 649678;
EXPIRATION_TIME = 1998-11-12T20:00:00Z;
OBJECT = FILE_GROUP;
    DATA_TYPE = 1A11;
    DATA_VERSION = 1;
    NODE_NAME = tsdssrv1.gsfc.nasa.gov;
    OBJECT = DP_CIO;
        DIRECTORY_ID = /tsdis1/tmi/1a ;
        FILE_ID = <tsdis file name>;
        FILE_TYPE = METADATA;
        FILE_SIZE = 1100;
    END_OBJECT = DP_CIO;
    OBJECT = FILE_SPEC;
    DIRECTORY_ID = /tsdis1/tmi/1a;
        FILE_ID = <tsdis file name>;
        FILE_TYPE = SCIENCE;
        FILE_SIZE = 242120;
        BEGINNING_DATE/TIME = 1998-11-08T18:36:18Z;
        ENDING_DATE/TIME = 1998-11-08T20:10:07Z;
    END_OBJECT = FILE_SPEC;
END_OBJECT = FILE_GROUP;
OBJECT = FILE_GROUP;
    DATA_TYPE = 1B11BR;
    DATA_VERSION = 1;
    NODE_NAME = tsdssrv1.gsfc.nasa.gov;
    OBJECT = FILE_SPEC;
        DIRECTORY_ID = /tsdis1/tmi/1b;
        FILE_ID = <tsdis file name>;
        FILE_TYPE = BROWSE;
        FILE_SIZE = 242120;
        BEGINNING_DATE/TIME = 1998-11-08T18:36:18Z;
        ENDING_DATE/TIME = 1998-11-08T20:10:07Z;
    END_OBJECT = FILE_SPEC;
END_OBJECT = FILE_GROUP;

```

Figure 4-8. Sample DAN PVL (TSDIS to ECS)

```

ORIGINATING_SYSTEM = ECS_GSFC_1;
CONSUMER_SYSTEM = TSDIS1;
DAN_SEQ_NO = 15326;
REQUEST_TYPE = Data Request;
ECS_ID = TSDIS1234;
TOTAL_FILE_COUNT = 2;
AGGREGATE_LENGTH = 349678;
EXPIRATION_TIME = 1998-11-10T20:00:00Z;
OBJECT = FILE_GROUP;
    DATA_TYPE = 1A11;
    DATA_VERSION = 1;
    NODE_NAME = eosrv.gsfc.nasa.gov;
    OBJECT = FILE_SPEC;
        DIRECTORY_ID = /eos.gsfc.server1;
        FILE_ID = <tsdis file name>;
        FILE_TYPE = SCIENCE;
        FILE_SIZE = 242120;
        BEGINNING_DATE/TIME = 1998-11-08T18:36:18Z;
        ENDING_DATE/TIME = 1998-11-08T20:10:07Z;
    END_OBJECT = FILE_SPEC;
END_OBJECT = FILE_GROUP;
OBJECT = FILE_GROUP;
    DATA_TYPE = 2B11BR;
    DATA_VERSION = 1;
    NODE_NAME = eosrv.gsfc.nasa.gov;
    OBJECT = FILE_SPEC;
        DIRECTORY_ID = /eos.gsfc.server1;
        FILE_ID = <tsdis file name>;
        FILE_TYPE = BROWSE;
        FILE_SIZE = 67561;
        BEGINNING_DATE/TIME = 1998-11-08T18:36:18Z;
        ENDING_DATE/TIME = 1998-11-08T18:43:07Z;
    END_OBJECT = FILE_SPEC;
END_OBJECT = FILE_GROUP;

```

Figure 4-9. Sample DAN PVL (ECS to TSDIS)

4.4.2 Data Availability Acknowledgment (DAA)

A DAA message is the corresponding handshake control message for the DAN. The DAA acknowledges receipt of the DAN and provides the mechanism to identify the status of data transfer scheduling and any DAN errors. The status of the DAN is provided in the disposition, where one of 32 bits is set to 1 to indicate which error occurred. The "Not used" bits are set to 0. The disposition reported in the DAA is where processing of the DAN stopped. A separate DAA is sent for each DAN. The short form of the DAA is used for both error-free DANs and DANs with the same disposition for all files. A long form of the DAA message is used when some file groups in the DAN have invalid parameters. The format and content of the short and long DAA messages is defined in Tables 4-9 and 4-10, respectively.

Table 4-9. Short DAA Message Definition

Field	Description	Type (Length in Bytes)	Value
Message Type	Short Data Availability Acknowledgment	Unsigned Integer (1)	2
Message Length	Length of Message in Bytes	Unsigned Integer (3)	13
DAN Sequence No.	Sequence number assigned by DAN sender	Integer (4)	DAN_SEQ_NO in DAN
Disposition	Disposition Bits -- meaning: Accepted Not used Invalid DAN sequence number Not used Not used Not used Invalid file count Not used Other errors Not used Not used Invalid DAN length Invalid aggregate length Database failures Duplicate DAN sequence # Spares	Logical Bits (4)	Bit location set to 1: none 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 - 31
Transfer Start Time	Not used	Integer (1)	Null

Table 4-10. Long DAA Message Definition

Field	Description	Type (Length in Bytes)	Value
Message Type	Long Data Availability Acknowledgment	Unsigned Integer (1)	3
Message Length	Length of Message in Bytes	Unsigned Integer (3)	Determined length of message in bytes
DAN Sequence No.	Sequence number assigned by DAN sender	Integer (4)	DAN_SEQ_NO in DAN
Number of File Groups (to follow)	Number of File Groups with Errors	Integer (4)	Number of File groups, in DAN, with errors

For each file group having errors in the Data Availability Notice:

Data Type PVL	ECS Data Type	ASCII String (≤ 20)	DATA_TYPE in DAN
Descriptor PVL	Name of instrument/sensor that collected the data	ASCII String (≤ 60)	DESCRIPTOR in DAN (Not Used)
Disposition	Disposition bits -- meaning: Invalid data version Invalid data type Not used Not used Invalid directory Not used Not used Not used Invalid file size field Not used Invalid time/date format Invalid file ID Not used Spare Invalid node name Invalid file type	Logical Bits (2)	Bit location set to 1: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

4.4.3 Data Delivery Notice (DDN)

A DDN is sent from the system which has completed retrieving the files via kftp from the data provider, to the data provider. The DDN announces the completion of data transfer, preprocessing, and archival, and identifies the success or reason for failure for each file. The short DDN is used for notification of the same disposition (including successful) for all files. The long DDN is used when at least one file has a different disposition. ECS processes files by file group; therefore, if one or more files encounters a processing error, processing ends for the entire file group. The error incurred is reported in the DDN disposition for each file in the affected file group. (TSDIS processes files individually.) If all files in a request do not have the same disposition, a long form of this message is employed. The format and content of the short and long DDN messages is defined in Tables 4-11 and 4-12, respectively. If the disposition is not 0 (successful), the value of the Time Stamp is Null (filled 20 byte ASCII string ending in 0 hex), and the Throughput value is 0.

Table 4-11. Short DDN Message Definition

Field	Description	Type (Length in Bytes)	Value
Message Type	Short DDN	Unsigned Integer (1)	11
Message Length	Length of Message/Bytes	Unsigned Integer (3)	40
DRR Sequence No.	Not used	Integer (4)	0
DAN Sequence No.	Sequence number assigned by DAN sender	Integer (4)	DAN_SEQ_NO parameter in DAN
Disposition	One of the following: Successful Network failure Unable to establish kftp connection Host denied access All file groups/files not found Kftp failure - Too many errors in file transfer Post-transfer double-check failed Kftp command failure Spares Metadata preprocessing error Data provider volume threshold exceeded System volume threshold exceeded Data provider request threshold exceeded System request threshold exceeded Resource allocation failure Recovery failure Database access error Incorrect number of metadata files Incorrect number of science files Incorrect number of files Data conversion failure Metadata checking failure Unknown data type Invalid or missing file type File I/O error Data archive error	Integer (1)	0 1 2 3 4 5 6 7 8 - 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255
Spares		(3)	
Time Stamp	ISO Time data transfer and validation completed	ASCII (20)	GMT in the format: yyyy-mm-ddThh:mm:ssZ where T and Z are literals (Null if disp >0)
Throughput	Rate in bytes per second averaged over all files	Integer (4)	≥0 (0 indicates disposition >0)

Table 4-12. Long DDN Message Definition (1 of

Field	Description	Type (Length in Bytes)	Value
Message Type	Long Data Delivery Notice	Unsigned Integer (1)	12
Message Length	Length of Message/ Bytes	Unsigned Integer (3)	Determined length
DRR Seq. No.	Not used	Integer (4)	0
DAN Sequence No.	Sequence number assigned by DAN sender	Integer (4)	DAN_SEQ_NO parameter in DAN
Number of Files	Number of Files in DAN	Integer (4)	TOTAL_FILE_COUNT parameter in DAN

Table 4-12. Long DDN Message Definition (2 of 2) For each File in the Data Availability Notice:

File Directory	ASCII string specifying file directory/path name	ASCII (≤ 256) length of DIRECTORY_ID	DIRECTORY_ID parameter in DAN
File Name	File names on system sending DAN	ASCII (≤ 256) length of FILE_ID	FILE_ID parameter in DAN
File Transfer Disposition	One of the following: Successful Network failure Unable to establish kftp connection Host denied access File not found Kftp failure - Too many errors in file transfer Post-transfer double-check failed Kftp command failure Spares Metadata preprocessing error Data provider volume threshold exceeded System volume threshold exceeded Data provider request threshold exceeded System request threshold exceeded Resource allocation failure Recovery failure Database access error Incorrect number of metadata files Incorrect number of science files Incorrect number of files Data conversion failure Metadata checking failure Unknown data type Invalid or missing file type File I/O error Data archive error	Integer (1)	0 1 2 3 4 5 6 7 8-238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255
Time Stamp	ISO Time of completed data transfer and validation	ASCII (20)	GMT in the format: yyyy-mm-ddThh:mm:ssZ where T and Z are literals (Null if disp>0)
Throughput	Rate in bytes per second for each file	Integer (4)	≥ 0 (0 indicates disposition > 0)

4.4.4 Data Delivery Acknowledgment (DDA)

A DDA is the corresponding handshake control message for the DDN. The DDA provides the mechanism for the provider of the data (i.e., ORIGINATING_SYSTEM as defined in the DAN PVL) to acknowledge receipt of the DDN. The format and content of the DDA message is defined in Table 4-13.

Table 4-13. DDA Message Definition

Field	Description	Type (Length in Bytes)	Value
Message Type	Short Data Delivery Acknowledgment	Unsigned Integer (1)	17
Message Length	Length of Message in Bytes	Unsigned Integer (3)	33
DRR Sequence No.	Not used	Integer (4)	0
DAN Sequence Number	Sequence number supplied by Originating System	Integer (4)	DAN_SEQ_NO in DAN
Disposition	One of the following: Successful Not used Error processing DDN - resend an operations tunable time later Spares	Integer (1)	0 1 2 3 - 255
Time Stamp	ISO Time when Consumer System transferred the last part of the data	ASCII (20)	Null

4.4.5 Data Request

The Data Request message is used by TSDIS to order products from ECS that are currently in the archive, to support TSDIS product reprocessing. TSDIS can also forward a Data Request from TSUs to the ECS DAAC. The volume of data ordered by TSDIS is defined in the IRD Between EOSDIS and the TRMM Ground System. Tables 4-14 and 4-15 defines the contents and format of the Data Request message header and PVL. The `DESTINATION_USER` parameter in the PVL indicates where the DAN will be sent, and therefore who will receive the data being requested. If TSDIS is to receive the data, the `DESTINATION_USER` parameter is set to the TSDIS processor ID to which ECS will send the DAN handshake control message. If the `DESTINATION_USER` is a mutually recognized TSU User ID the TSU is notified via e-mail when the requested data are ready to be retrieved by ftp, or when the data are physically mailed out on the requested `MEDIA_TYPE`. The `DELIVERY_TYPE` parameter indicates whether the delivery will occur via ftp or media; if 'media', then `MEDIA_TYPE` is set to '8 mm tape'. TSDIS does not receive data on media; however, TSUs usually do.

Data are requested, in a single Data Request, either by TSDIS `FILE_ID` (whole file name, which is the TSDIS Granule ID) or by a search of parameters contained in the `SEARCH_GROUP` object (not both). The `FILE_ID` parameter is repeatable within the `FILE_GROUP` object in the Data Request PVL, to accommodate ordering more than one `FILE_ID`. The `SEARCH_GROUP` object is not repeatable so only one search can be performed per Data Request. All files (i.e., versions) of files satisfying the search parameters are staged. Note that there is one file per TSDIS granule (not including separate metadata files).

If the number of files (`TOTAL_FILE_COUNT`) reported in the DAN is less than the number ordered in the Data Request, the missing files were not found in the archive. A file count of 0 indicates that an error occurred in the process of searching and acquiring one or more files in the Data Request.

TSDIS provides the file IDs to ECS when the data are originally sent by TSDIS to ECS, via the `FILE_ID` parameter in the DAN (see Section 4.4.1) and in the product specific metadata. The IDs are a combination of TSDIS data type, orbit number, and time associated with the data. Browse file IDs always end with ".BRO". ECS uses the same `FILE_ID`s in the DAN for notification of data availability after TSDIS orders the data for reprocessing. The files are accordingly also staged with those same names. Metadata files (ASCII, in ODL format) are staged along with the product data files (if the metadata was updated since file archive). TSUs require these metadata files and are notified of their existence along with the associated products; however, by TSDIS request, ECS does not notify TSDIS of the existence of the staged metadata files because TSDIS already has the updated metadata in a database and not retrieving the files upon notification would complicate the long DDN message sent to ECS.

Table 4-14. Data Request**HEADER**

Field	Description	Type (Length in Bytes)	Value
Message Type	Indicates Data Request	Unsigned Integer (1)	30
Message Length	Length of Message in bytes	Unsigned Integer (3)	≥ 265

Table 4-15. Data Request**PVL**

Parameter	Description	Type /Format (Max Length in Bytes)	Valid Values
ORIGINATING_SYSTEM	Originator of data request	Variable String / ASCII (20)	TSDIS Processor ID e.g., 'TSDIS1'
DESTINATION_USER	TSU User ID or TSDIS Processor ID to which ECS sends DAN	Variable String / ASCII (20)	TSU User ID or TSDIS Processor ID
DR_SEQ_NO	Sequence number assigned by TSDIS	Unsigned 32-bit Integer / ASCII (10)	$\leq 4.295 \times 10^9$
DELIVERY_TYPE	Type of delivery to use	Variable String / ASCII (10)	'ftp_pull' or 'media'
MEDIA_TYPE	If DELIVERY_TYPE is media, specify media type	Variable String / ASCII (10)	'8 mm tape'
OBJECT	Start of File group	Fixed String / ASCII (10)	'FILE_GROUP'
FILE_ID	TSDIS File_ID in ASCII (1 file per granule) - Repeatable within the File Group	Variable String / ASCII (48)	Valid TSDIS FILE_ID as defined in the DAN FILE_ID and the product metadata
END_OBJECT	End of File Group	Fixed String / ASCII (10)	'FILE_GROUP'
OBJECT	Start of file group parameters	Fixed String / ASCII (12)	'SEARCH_GROUP'
FILE_TYPE	ECS File Data Type	Variable String / ASCII (20)	'BROWSE', 'SCIENCE'

Table 4-15. Data RequestPVL (continued)

Parameter	Description	Type / Format (Max Length in Bytes)	Valid Values
DATA_TYPE	ECS Data Type	Fixed String / ASCII (20)	Valid ECS Data Type as listed in Tables 5-4 and 5-5 of this document
BEGINNING_DATE/ TIME	ISO Start time of data, as supplied in the metadata	Fixed String / ASCII (20)	GMT in the format: yyyy-mm-ddThh:mm:ssZ where T and Z are literals
ENDING_DATE/TIME	ISO End time of data, as supplied in the metadata	Fixed String / ASCII (20)	GMT in the format: yyyy-mm-ddThh:mm:ssZ where T and Z are literals
END_OBJECT	End of search group	Fixed String / ASCII (12)	'SEARCH_GROUP'

4.4.6 Data Request Acknowledgment (DRA)

ECS sends a DRA in response to a Data Request. The DRA message notifies TSDIS that either the Data Request has been received, properly parsed, and queued by the ECS data server or is incorrectly formulated and has been rejected. It also provides TSDIS with a unique ID, for future use in product statusing, cancellation of data requests, and/or correlating with the DAN received from ECS upon staging for retrieval. Table 4-16 defines the content and format of the DRA header and PVL. The DRA reports a disposition which rejects the Data Request if the Data Request is formulated incorrectly (i.e., the required parameters are not present for either a FILE_GROUP object or a SEARCH_GROUP object), or if there was a network error.

Table 4-16. Data Request Acknowledgment**HEADER**

Field	Description	Type (Length in Bytes)	Value
Message Type	Data Request Acknowledgment	Unsigned Integer (1)	31
Message Length	Length of Message in Bytes	Unsigned Integer (3)	≤ 119
Disposition	One of the following: Successful Validation failure Network error	Integer (1)	0 1 2

PVL

Field	Description	Type /Format (Max Length in Bytes)	Value
ECS_ID	ECS-returned ID of submitted Data Request	Variable String / ASCII (20)	unique ID
ORIGINATING_SYSTEM	Originator of Data Request	Variable String / ASCII (20)	TSDIS Processor ID from Data Request
DESTINATION_USER	TSU user ID or TSDIS processor ID DAN destination (final data destination)	Variable String / ASCII (64)	DESTINATION_USER in Data Request
DR_SEQ_NO	Associated Data Request Sequence Number	Unsigned 32-bit Integer / ASCII (10)	≤ 4.295*10 ⁹

4.4.7 Data Subscription Request (DSR)

A DSR is used to order data from ECS, based on the occurrence of a future event. In this case, TSDIS submits one Data Subscription to ECS at the GSFC DAAC for each type of requested ancillary data, with the action to notify TSDIS when the desired data are newly inserted in the archive at that ECS DAAC and have been staged for retrieval. Table 4-17 defines the contents and format of the Data Subscription Request header and PVL.

Table 4-17. Data Subscription RequestHEADER

Field	Description	Type (Length in Bytes)	Value
Message Type	Subscription Request	Unsigned Integer (1)	32
Message Length	Length of Message in Bytes	Unsigned Integer (3)	≤ 86

PVL

Field	Description	Type / Format (Max Length in Bytes)	Values
ORIGINATING_SYSTEM	Originator of Data Subscription Request	Variable String / ASCII (20)	TSDIS Processor ID e.g., 'TSDIS1'
DS_SEQ_NO	Subscription Sequence Number assigned by Originating System	Unsigned 32-bit Integer / ASCII (10)	$\leq 4.295 * 10^9$
EVENT_ID	ECS-Defined Event ID	Variable String / ASCII (20)	'INSERT_FNL', 'INSERT_SSMI' (TBR), 'INSERT_GPCC' (TBR), 'INSERT_GPI' (TBR)
ACTION_ID	ECS-Defined Action ID	Fixed String / ASCII (12)	'STAGE/NOTIFY'
EXPIRATION_DATE	ISO Subscription Expiration Date	Fixed String / ASCII (20)	GMT in the format: yyyy-mm-ddThh:mm:ssZ where T, Z are literals

4.4.8 Data Subscription Acknowledgment (DSA)

A DSA is the message sent to TSDIS by ECS confirming that a Data Subscription has been received from TSDIS and registered by ECS. It returns the Data Subscription sequence number as confirmation and an ECS ID to be used for any future cancellation or status requests concerning the submitted Data Subscription. ECS IDs for Data Requests and Subscriptions are all unique, so that an ID from a Data Request can be discernible from that of a Subscription. Table 4-18 defines the contents and format of the Data Subscription Acknowledgment header and PVL.

Table 4-18. Data Subscription AcknowledgmentHEADER

Field	Description	Type (Length in Bytes)	Value
Message Type	Subscription Acknowledgment	Unsigned Integer (1)	33
Message Length	Length of Message in Bytes	Unsigned Integer (3)	≤ 55
Disposition	One of the following: Successful Invalid Event ID Invalid Action ID	Integer (1)	0 1 2

PVL

Field	Description	Type /Format (Max Length in Bytes)	Value
ORIGINATING_SYSTEM	Originator of Data Subscription Request	Variable String / ASCII (20)	TSDIS Processor ID
DS_SEQ_NO	Subscription Sequence Number assigned by TSDIS	Unsigned 32-bit Integer / ASCII (10)	≤ 4.295*10 ⁹
ECS_ID	ECS-returned ID of submitted subscription	Variable String / ASCII (20)	unique ID

4.4.9 Product Order Status Request

The Product Order Status Request (POSR) message is sent by TSDIS to ECS and enables TSDIS to check on the status of a Data Request or Data Subscription which has been submitted to ECS. The content and format of the Product Order Status Request header and PVL is defined in Table 4-9.

Table 4-19. Product Order Status RequestHEADER

Field	Description	Type (Length in Bytes)	Value
Message Type	Data Request Status Request or Subscription Status Request	Unsigned Integer (1)	Data Request = 34 Subscription = 35
Message Length	Length of Message in Bytes	Unsigned Integer (3)	≤ 44

PVL

Field	Description	Type / Format (Max Length in Bytes)	Value
ORIGINATING_SYSTEM	Originator of Status Request	Variable String / ASCII (20)	TSDIS Processor ID
ECS_ID	Subscription ID or Data Request ID to status	Variable String / ASCII (20)	ECS_ID in DRA or DSA

4.4.10 Product Order Status

The Product Order Status (POS) message is sent by ECS to TSDIS as a response to the Product Order Status Request. It returns to TSDIS the status of a Data Request or Data Subscription which has been submitted to ECS. The format and contents of a Product Order Status message header and PVL is defined in Table 4-20.

Table 4-20. Product Order Status HEADER

Field	Description	Type (Length in Bytes)	Value
Message Type	Data Request Status or Subscription Status	Unsigned Integer (1)	Data Request = 36 Subscription = 37
Message Length	Length of Message in Bytes	Unsigned Integer (3)	≤ 65
Disposition	One of the following: Successful Validation failure ECS_ID not found	Integer (1)	0 1 2

PVL

Field	Description	Type / Format (Max Length in Bytes)	Value
ORIGINATING_SYSTEM	Originator of Status Request	Variable String / ASCII (20)	TSDIS processor ID
ECS_ID	Data Request ID or Subscription ID to status	Variable String / ASCII (20)	ECS_ID in Status Request
ECS_ID_STATUS	Status of request	Variable String / ASCII (20)	'PENDING', 'STAGING', 'TRANSFERRING', 'WAITING FOR SHIPMENT' (8 mm tape), 'SHIPPED' (8 mm tape), 'TRANSFERRED', 'DATA NON-RECOVERABLE' (TBR)

4.4.11 Product Order Cancellation Request

The Product Order Cancellation Request (POCR) message is sent by TSDIS to ECS. It enables TSDIS to cancel any Data Request or Data Subscription which has been submitted to ECS and is queued to process but has not yet been processed by ECS. Once the request is dequeued (as discerned through a Product Order Status Request) it cannot be cancelled, such as when files are being retrieved for staging or written to output media. It includes the ID provided in the DRA or DSA message. Table 4-21 defines the format and content of the Product Order Cancellation Request header and PVL.

Table 4-21. Product Order Cancellation Request**HEADER**

Field	Description	Type (Length in Bytes)	Value
Message Type	Data Request Cancellation Request or Subscription Cancellation Request	Unsigned Integer (1)	Data Request = 38 Subscription = 39
Message Length	Length of Message in Bytes	Unsigned Integer (3)	≤ 44

PVL

Field	Description	Type / Format (Max Length in Bytes)	Value
ORIGINATING_SYSTEM	Originator of Cancellation Request	Variable String / ASCII (20)	TSDIS Processor ID
ECS_ID	ID of Data Request or Subscription to cancel	Variable String / ASCII (20)	ECS_ID from DRA or DSA

4.4.12 Product Order Cancellation

The Product Order Cancellation (POC) message enables ECS to acknowledge receipt of a Data Request or Subscription Cancellation Request. It notifies TSDIS that the ID of the Data Request or Subscription (ECS_ID) has been cancelled, by returning a disposition of 0, with the PVL containing the ECS_ID. The message header and PVL format and contents is defined in Table 4-22.

Table 4-22. Product Order Cancellation HEADER

Field	Description	Type (Length in Bytes)	Value
Message Type	Data Request Cancellation or Data Subscription Cancellation	Unsigned Integer (1)	Data Request = 40 Subscription = 41
Message Length	Length of Message in Bytes	Unsigned Integer (3)	≤45
Disposition	One of the following: Successful Validation failure ECS_ID not found in queue	Integer (1)	0 1 2

PVL

Field	Description	Type / Format (Max Length in Bytes)	Value
ORIGINATING_SYSTEM	Originator of Cancellation Request	Variable String / ASCII (20)	TSDIS processor ID
ECS_ID	ID of Data Request or Subscription requested to be cancelled	Variable String / ASCII (20)	ECS_ID in DRA or DSA

4.4.13 Metadata Update Request (MUR)

After the TSDIS Scientists have completed evaluating the products, they will need to update Quality Indicator metadata parameter values that were not known at the time of initial product archive. TSDIS sends ECS a Metadata Update Request containing the file (granule) ID of the product; and the metadata parameters and values to be updated. Table 4-23 defines the content and format of the MUR header and PVL.

Table 4-23. Metadata Update Request**HEADER**

Field	Description	Type (Length in Bytes)	Value
Message Type	Metadata Update Request	Unsigned Integer (1)	42
Message Length	Length of Message in Bytes	Unsigned Integer (3)	≤ 1,048,576

PVL

Parameter	Description	Type / Format (Max Length in Bytes)	Valid Values
ORIGINATING_SYSTEM	Originator of Metadata Update Request	Variable String / ASCII (10)	TSDIS Processor ID
MUR_SEQ_NO	Metadata Update Request Sequence number assigned by TSDIS	Unsigned 32-bit Integer / ASCII (10)	≤ 4.295*10 ⁹
OBJECT	Start of File group (repeat File groups for multiple values of Quality Indicator)	Fixed String / ASCII (10)	'FILE_GROUP'
FILE_ID	TSDIS FILE_ID in ASCII (repeatable within the FILE_GROUP)	Variable String / ASCII (64)	Valid TSDIS FILE IDs
QUALITY_INDICATOR	quality flag for FILE IDs listed in 'FILE_GROUP' (one per file group)	Variable String / ASCII (10)	'UNCHECKED', 'PASS', 'FAIL'
QUALITY_COMMENT	comment field associated with QUALITY_INDICATOR (one per file group)	Variable String / ASCII (80)	80- character comment
END_OBJECT	End of file group	Fixed String / ASCII (10)	'FILE_GROUP'

4.4.14 Metadata Update Acknowledgment (MUA)

ECS sends a MUA in response to a Metadata Update Request. The MUA message notifies TSDIS that either the Metadata Update Request has been received, properly parsed, and the requested Quality Indicator metadata parameters have been updated (disposition equals 0) or the request is incorrectly formulated and has been rejected. Table 4-24 defines the content and format of the MUA.

Table 4-24. Metadata Update Acknowledgment

HEADER

Field	Description	Type (Length in Bytes)	Value
Message Type	Metadata Update Acknowledgment	Unsigned Integer (1)	43
Message Length	Length of Message in Bytes	Unsigned Integer (3)	≤ 35
Disposition	Successful Validation failure	Integer (1)	0 1

PVL

Field	Description	Type /Format (Max Length in Bytes)	Value
ORIGINATING_SYSTEM	Originator of Metadata Update Request	Variable String / ASCII (20)	TSDIS Processor ID from Metadata Update Request
MUR_SEQ_NO	Associated Metadata Update Request Sequence Number	Unsigned 32-bit Integer / ASCII (10)	≤ 4.295*10 ⁹

5. Product/Data Flow Descriptions

This section defines the contents and formats for each Data Flow between TSDIS and ECS. Many of these flows are based on common formats which are described in Section 5.1; metadata is addressed in Section 5.2. Sections 5.3 through 5.7 define the product transfer information for each ECS-TSDIS interface, including the frequency. Product volumes are documented in the Interface Requirements Document (IRD) Between the Earth Observing System Data and Information System (EOSDIS) and the Tropical Rainfall Measuring Mission (TRMM) Ground System and detailed in Appendix B of the TSDIS Requirements Document. Figure 5-1 shows the product data flows defined by this ICD.

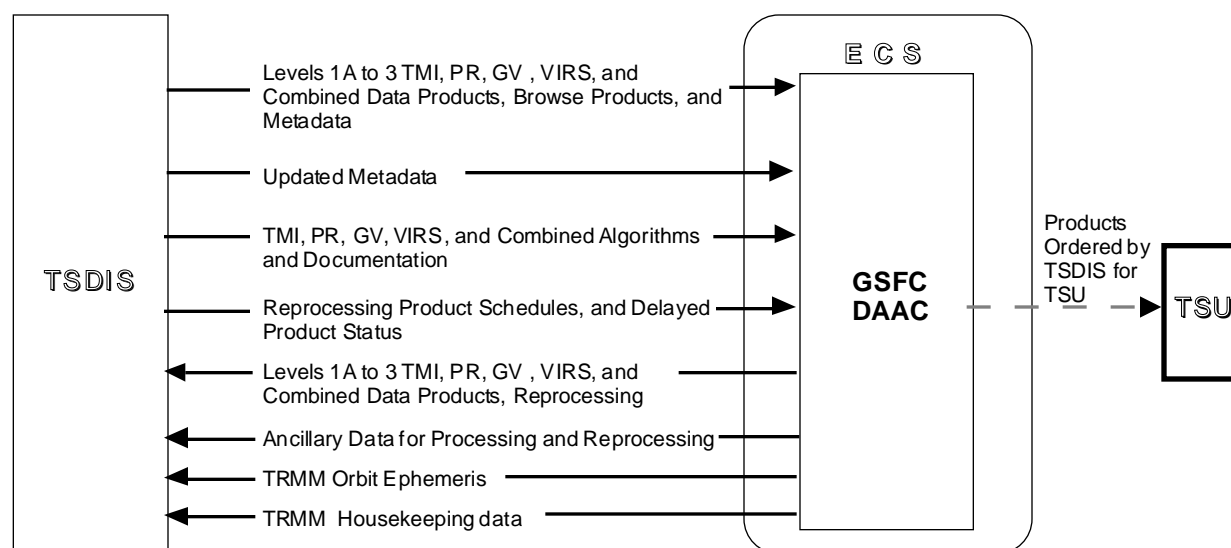


Figure 5-1. Data Flows Between ECS and TSDIS

5.1 Common Data Formats

This section contains information about the Detached Standard Formatted Data Unit (SFDU) Header and the ECS-specific Hierarchical Data Format (HDF) (HDF-EOS). These structures are common to the formats of many of the products transferred between ECS and TSDIS. Products are either in HDF-EOS format or have a Detached SFDU Header, for storage and to facilitate extraction of metadata. Specific product formats are described in the Interface Control Specification Between the TSDIS and the TSU, dated March 1996 (TBR).

5.1.1 Detached SFDU Header

The Detached SFDU header, which is described in detail in CCSDS 620.0-B-2 (Standard Formatted Data Units - Structure and Construction Rules), consists of standard labels that uniquely identify and link a data set file to its description. The structure of the SFDU header and files is depicted in Figure 5-2.

The header consists of three Label Value Objects (LVO): an SFDU Exchange Data Unit (EDU) Label, a Contents Identifier Object (CIO), and a Reference Identifier Object (RIO). The CIO and RIO objects each consist of a label field and a value field. In the ECS/TSDIS interface, the label fields are not used and are zero filled, except for the last 8 bytes of the CIO label which contains the combined length of the CIO values, the RIO label, and the RIO values. The CIO values are in PVL format, and delimited by semicolons. The CIO PVL value field contains the parameters used to describe the data products being transferred between TSDIS and ECS. The RIO value field is not used in this interface. The format and values of these objects are shown in Table 5-1. The PVL parameters comprising the CIO values are defined in Table 5-2.

Data set files are elements of a data product transferred in file format to the consumer. The header is separate from the data files, but references them and is delivered with them. One Detached SFDU header references one file (one granule). Data set files are transferred in a non-HDF format, and consist of a Data Set File Header, a unique data set, and quality and accounting information for data errors.

Detached SFDU Header

SFDU EDU Label
SFDU CIO Label
SFDU CIO Value
SFDU RIO Label
SFDU RIO Value

Data Set File Header
Data Set File
quality and accounting info

Figure 5-2. SFDU Header and File Structure
Table 5-1. Label Value Objects

Data Item	Description	Type (Length in Bytes)	Value
EDU Label	Not used	ASCII (20)	20 bytes fill
CIO Label - 1st 12 bytes	Not used	ASCII (12)	12 bytes fill
last 8 bytes	Byte length in ASCII (including line feeds) of the CIO values plus the RIO Label and RIO Values	ASCII (8)	≤ '99999999'
CIO Values	PVL	see Table 5-2	see Table 5-2
RIO Label	Not used	Fixed String / ASCII(20)	20 bytes fill
RIO Values	Not used	Fixed String / ASCII (0)	none

Table 5-2. CIO PVL Values

Data Item	Description	Type / Format (Max Length in Bytes)	Value
DATA_TYPE	ECS Data Type of the data set	Variable String / ASCII (20)	Valid ECS Data Type as noted in Tables 5-4
START_DATE	ISO Start time of data in REF_FILE	Fixed String / ASCII (20)	GMT in the format: yyyy-mm-ddThh:mm:ssZ where T and Z are literals
STOP_DATE	ISO End time of data in REF_FILE	Fixed String / ASCII (20)	GMT in the format: yyyy-mm-ddThh:mm:ssZ where T and Z are literals
GENERATION_DATE	ISO Date/time the product was generated	Fixed String / ASCII (20)	GMT in the format: yyyy-mm-ddThh:mm:ssZ where T and Z are literals
REF_FILE	File for which the following START_DATE and STOP_DATE parameters apply	Variable String / ASCII (256)	file name

5.1.2 HDF-EOS Data Taxonomy

The Hierarchical Data Format (HDF) is used to transfer products between ECS and TSDIS. All levels of TSDIS data products above level 1A products, except GV level 2A52 data, as well as browse packages, are in HDF-EOS format. The basis of the HDF-EOS format is a file organization which can support a variety of data models for accessing scientific and related data. These data models include 8-bit and 24-bit raster images and associated palettes, multi-dimensional arrays of Scientific Data Sets (SDS), annotation for the representation of ASCII data, binary tables (Vdata), and Vgroup structures to create user defined relational objects. A browse product includes one or more raster images with associated palettes, tables of numbers, and text. Table 5-3 lists HDF-EOS data types as described in the HDF-EOS Primer for Version 1 EOSDIS.

Table. 5-3 HDF-EOS Data Types

Datatype	Definition	SubTypes
ASCII Text	Descriptive Text	Plain, Formatted
P=V Metadata (ODL)	Parameter=Value Info	Binary, Text
Science Data Table	Tabular Data	Standard, Index
Image	Raster Image	8-bit Image, 24-bit Image
N-Dimensional Array	array of science data	Array of Records, of Scalars
Grid	Data projected on grid	Rectangular, Structured Grid
Swath	Satellite ground track	Simple, Complex
Point	Station Data	Standard, Index
Data Dictionary	Dictionary of P=V words	N/A
Structure	Group of Datatypes	N/A

The contents and formats of all the TSDIS products in HDF-EOS format have been mutually agreed upon by TSDIS and ECS, are documented in the March 1996 (TBR) version of the Interface Control Specification Between the TSDIS and the TSU, and are supported by ECS throughout the lifetime of the TRMM mission. Compression/decompression of products in the HDF-EOS format is accomplished using HDF provided compression/decompression tools, TSDIS compresses some parts of HDF-formatted products and browse files, such as the SDSs, before archiving them at ECS. Metadata are not compressed.

5.2 Metadata

TSDIS provides core and product-specific metadata with each science and browse product, derived from TSDIS processing and reprocessing. The metadata is included in each product file in HDF-EOS format (levels 1B through 3, except the 2A52 (GV) product) and in the CIO PVL values in the Detached SFDU header for the level 1A data. The metadata for the 2A52 product is also in a Detached SFDU header. ECS provides only the services defined in this ICD for products with metadata in an SFDU header.

TSDIS updates Quality Indicator metadata parameters via the Metadata Update Request message, described in Section 4.4.13.

TSDIS provides collection level metadata and guide (documentation) level metadata to ECS before TRMM launch and as needed after launch. Collection level metadata (ODL, in ASCII file) and guide metadata (V0 guide set of attributes) are provided through the ECS HTML interface. TSDIS places files containing collection and guide level metadata into a configured ECS directory, using kftp. TSDIS notifies ECS of the availability of these files by submitting an HTML form, with file types and data types, at the appropriate ECS World Wide Web (WWW) page. After receipt and acceptance of the HTML form, ECS ingests the metadata.

The minimum core metadata TSDIS must provide to ECS is described in the document SDPS Database Design and Database Schema Specifications for the ECS Project (DID 311), dated December 1995. The actual core and product specific metadata parameters which TSDIS provides to ECS are documented in Volume 3 of the Interface Control Specification Between the TSDIS and the TSU, dated March 1996 (TBR). TSDIS provides the TSDIS granule ID in the metadata for each granule. TSDIS also provides the agreed upon metadata parameters needed for ECS to map browse granules to the science files used to create them.

5.3 TSDIS to ECS/GSFC Interface

The purpose of this interface is for ECS at the GSFC DAAC to receive and ingest data products, algorithms, and documentation from TSDIS. ECS archives and distributes these data products as a service for TSDIS. Data are delivered electronically, following the message and data flow shown in Figure 4-1, unless noted otherwise.

5.3.1 TRMM TMI, PR, VIRS, Combined, and GV Data and Products

These data include TMI, PR, and VIRS level 1A data; levels 1B through 3B standard science data products derived from TMI, PR, and VIRS instrument data via TSDIS processing and reprocessing; levels 1B to 3A ground validation (GV) data products derived from 11 ground radar sites; levels 2B and 3B combined products; and associated browse products. ECS/GSFC receives from TSDIS 24 hours worth of processed data products daily (except level 3 products, which are made available to ECS/GSFC at 5-day and 1-month intervals), and 2 days worth of reprocessed data products daily during reprocessing periods. Science products must be inserted into the ECS archive either before or at the same time as the associated browse products due to ECS mapping; therefore, TSDIS either sends them in the same DAN or the browse files in a later

DAN. The approximate numbers of files of TMI, PR, VIRS, GV, and combined processed products, their frequency of transfer from TSDIS, and ECS data type (both science and browse, as applicable), are listed in Table 5-4. The number of files may change, but the total volume is as specified in the IRD Between the EOSDIS and the TRMM Ground System. The data products, formats and contents are detailed in the Interface Control Specification Between the Tropical Rainfall Measuring Mission (TSDIS) and the TSU, dated March 1996 (TBR).

All of the products in Table 5-4 are in HDF-EOS format except the level 1A data products and the 2A52 product, which contain a Detached SFDU header.

Table 5-4. Product Data Types, Algorithms, and Frequencies

ECS Data Types Science (Browse)	Algorithm Names	Total # Science Files/ Frequency	#Browse files / frequency
1A01 (none)	1A-VIRS	16 files + 16 Detached SFDU headers/Day	0
1A11 (none)	1A-TMI	16 files+ 16 Detached SFDU headers/Day	0
1A21 (none)	1A-PR	16 files + 16 Detached SFDU headers/Day	0
1B01 (1B01BR)	VIRS Radiance	16 files/ Day	1 file/Day
1B11 (1B11BR)	TMI Brightness Temperatures	16 files/Day	1 file/Day
1B21 (1B21BR)	PR Power	16 files/Day	1 file/Day
1B51 (none)	GV Calibration	264 files/Day	0
1C21 (1C21BR)	PR Reflectivities	16 files/Day	1 file/Day
1C51 (1C51BR)	GV QC Radar Reflectivity	264 files/Day	11 files /Day
2A12 (2A12BR)	TMI Profiling	16 files/Day	1 file/Day
2A21 (2A21BR)	PR Surface Cross Section	16 files/Day	1 file/Day
2A23 (2A23BR)	PR Qualitative	16 files/Day	1 file/Day
2A25 (2A25BR)	PR Profile	16 files/Day	1 file/Day
2A52 (none)	GV Rain Existence	11 files + 11 Detached SFDU Headers/Day	0
2A53 (2A53BR)	GV Radar Site Rain Map	264 files/Day	11 files/Day
2A54 (2A54BR)	GV Radar Site Conv./Stratiform Map	264 files/Day	11 files/Day
2A55 (2A55BR)	GV Radar Site 3-D Reflectivities	264 files/Day	11 files/Day
2A56 (none)	GV Rain Gauge	11 files/Month	0
2A57 (none)	GV Disdrometer	11 files/Month	0
2B31 (2B31BR)	TRMM Combined	16 files/Day	1 file/Day
3A11 (3A11BR)	TMI Emission	1 file/Month	1 file/Month
3A25 (3A25BR)	PR Rainfall	1 file/Month	1 file/Month
3A26 (3A26BR)	PR Surface Rain	1 file/Month	1 file/Month
3A53 (3A53BR)	GV 5-day Site Rain Map	11 files/5 days	11 files/5 Days
3A54 (3A54BR)	GV 30-day Site Rain Map	11 files/Month	11 files/Month
3A55 (3A55BR)	GV Monthly 3D-Structure	11 files/Month	11 files/Month
3B31 (3B31BR)	Rainfall Combined	1 file/Month	1 file/Month
3B42 (3B42BR)	TRMM and Others GPI Calibration	1 file/5 Days	1 file/5 Days
3B43 (3B43BR)	TRMM and Others Data Sources	1 file/5 Days	1 file/5 Days
3A46 (none)	TRMM and Others SSM/I Monthly Gridded Rainfall	1 file/Month	0

5.3.2 TRMM TMI, PR, VIRS, Combined, and GV Algorithms and Documentation

ECS/GSFC receives algorithm packages and documentation from TSDIS initially before launch, then after they have been updated for data reprocessing. Updates are anticipated at 6, 12, 24, and 36 months after instrument checkout. In addition, algorithms may be updated at 45 days and 4 months after launch, during the instrument checkout. (Note, however, that there is no restriction on when the data may be sent to ECS.)

The contents of a TSDIS algorithm package are defined in the Interface Control Specification Between the Tropical Rainfall Measuring Mission (TSDIS) and the TSU, dated March 1996 (TBR).

TSDIS places files containing algorithms and documentation into a configured ECS directory, using kftp. Metadata for these files are placed in separate files. TSDIS notifies ECS of the availability of these files, including the metadata, by submitting an HTML form at the appropriate ECS WWW page. After receipt and processing of the HTML form, ECS ingests the files. ECS accepts document files from TSDIS in any of the following formats: Adobe Acrobat pdf, ASCII text, rtf, HTML, and postscript.

5.4 ECS/GSFC to TSDIS Interface

The purpose of this interface is for ECS at the GSFC DAAC to provide to TSDIS the following TSDIS and ancillary data products. Data are delivered electronically, following the message and data flow shown in Figure 4-2, unless noted otherwise.

5.4.1 TRMM TMI, PR, VIRS, Combined and GV Levels 1A-3B Data for Reprocessing

TSDIS submits Data Requests daily to ECS/GSFC, during reprocessing periods, for archived levels 1A through 3B of TMI, PR, VIRS, combined, and GV (except level 1A) standard data products, for the purpose of TSDIS reprocessing. The data products, formats and contents are specified in the Interface Control Specification Between the TSDIS and the TSU, dated March 1996 (TBR).

5.4.2 TRMM Orbit Ephemeris

TSDIS submits a Data Request, using the SEARCH_GROUP object to ECS/GSFC for orbit ephemeris data for product reprocessing. This is the definitive and predictive orbit data which TSDIS and ECS receive from the Sensor Data Processing Facility (SDPF) and is archived at ECS. The orbit ephemeris is the binary EPHEM format produced by the FDF, which is referenced in Section 10 of the ICD Between the SDPF and the TRMM Consumers ICD. Each 9-day ephemeris file contains 34 hours worth of definitive orbit data. The ECS Data Type for the ephemeris, needed for the Data Request, is shown in Table 5-5.

5.4.3 TRMM Level 0 Housekeeping Data

ECS/GSFC provides these data, to TSDIS as needed, in response to a Data Request, using the SEARCH_GROUP object, from TSDIS. The format and content of these data is documented in the TRMM Telemetry and Command Handbook and in Section 10 of the ICD Between the SDPF and the TRMM Consumers ICD. The ECS Data Type for the housekeeping file, needed for the Data Request, is shown in Table 5-5.

5.5 Ancillary Data

TSDIS submits a Data Subscription to ECS to obtain ancillary data for use in generating processed data products. As soon as the ancillary data are received in the ECS archive, the data are staged for retrieval and TSDIS is notified. Each day during reprocessing periods, TSDIS submits a Data Request for ancillary data products for data to be used for reprocessing on the following day.

Refer to the Interface Requirements Document (IRD) Between the Earth Observing System Data and Information System (EOSDIS) and the Tropical Rainfall Measuring Mission (TRMM) Ground System for more information on ancillary data volumes and requirements.

The ECS Data Types for the ancillary data products, used for ordering the data for reprocessing, are defined in Table 5-5.

5.5.1 Special Sensor Microwave/Imager (SSM/I)

The EOSDIS Core System will not provide SSM/I Brightness Temperature to TSDIS.

5.5.2 Global Precipitation Climatology Project (GPCP) (TBR)

ECS provides GPCP Satellite-Derived (IR) Monthly Rainfall Estimates to TSDIS. These are gridded monthly accumulations of estimated rainfall in 2.5x2.5 degree bins (possible future product of 1x1 degree bins), with geographic coverage +/- 40 degrees latitude. Data covering several months are updated every few months and are provided to TSDIS as soon as they become available, in native format. The data are a product of the National Environmental Satellite Data and Information Service (NESDIS) Climate Analysis Center (CAC). (Refer to the Interface Control Document (ICD) Between the EOSDIS Core System (ECS) and the Marshall Space Flight Center (MSFC) Distributed Active Archive Center (DAAC) for more information.)

5.5.3 Global Precipitation Climatology Center (GPCC) (TBR)

ECS provides GPCC Global Precipitation data to TSDIS, in native format. These are global gridded monthly mean rainfall totals (raingauge data with some satellite and model-generated data for oceans) in 2.5x2.5 degree bins. These data are produced at the GPCC in Germany, which updates the data every few months. (Refer to the Interface Control Document (ICD) Between the EOSDIS Core System (ECS) and the Marshall Space Flight Center (MSFC) Distributed Active Archive Center (DAAC) for more information.)

5.5.4 National Meteorological Center (NMC)

ECS/GSFC provides the Final Analysis and Forecast System, Global Analysis (FNL) NMC Gridded Data Product. ECS/GSFC obtains 4 files per day (one every 6 hours) from NOAA, via the GSFC DAAC for use by TSDIS. The FNL product is received at ECS in NOAA's GRid In Binary (GRIB) format, which is described in NOAA Office Note 388 (ON 388). The product is available to TSDIS in the native GRIB format. File names follow the convention: fnl.ced1.ganl.yymmdd.HHz, for HH = 00, 06, 12, and 18.

Table 5-5. ECS Data Types for Ancillary Data, Ephemeris, and Housekeeping Products (TBR)

ECS Data Type (TBR)	Product	Total # Files/Frequency
SSMI (TBR)	SSMI Brightness Temperatures	TBR
FNL	NMC Final Analysis and Forecast System	4/Day
GPCP (TBR)	Global Precipitation product (TBR)	several every few months (TBR)
GPCC (TBR)	GPCC Global Gauge Analyses (TBR)	several every few months (TBR)
EPHEM (TBR)	TRMM Orbit Ephemeris	1 per Day
HSK (TBR)	TRMM L0 Housekeeping	1 per Day

5.6 ECS to TSU Interface

The purpose of this interface is for ECS at the GSFC DAAC to provide to TSUs any of the TSDIS data products that TSDIS can order via a Data Request. Data are delivered following the message and data flow described in Section 4.3.3.

5.7 Product Schedules

5.7.1 TSDIS Product Schedule

The purpose of this interface is for TSDIS to provide ECS/GSFC with a schedule for reprocessing products, prior to each reprocessing period. This schedule is delivered via fax, hard copy, or e-mail, and serves as a guideline for ECS in DAAC operations planning.

5.7.2 TSDIS Delayed Product Status

The purpose of this interface is for TSDIS to notify ECS/GSFC of any problems in product processing that may impact DAAC operations. TSDIS notifies ECS as needed, via telephone, fax, hard copy, or e-mail, of an expected delay in product availability.

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Appendix A. Work-off Plan for ECS-TSDIS Release A ICD

ICD Issue #	ICD Para. #	Issue Priority *	ICD Issue Type - Description	Work-off Plan Task(s)	Projected Resolution Date
1	4.3.2.1 and 4.4.10	B	TBR -The status values that can/will be returned in response to a Product Order Status Request are not resolved. More values are expected. Also, which values can be returned to TSDIS at various stages in the order processing and after completion of the order is not resolved.	ECS Data Server group will finalize these.	5/96
2	4.4.7, 5.5.1, and Table 4-17	A	TBR - SSM/I Archive at ECS not resolved.	A CCR to the TRMM IRD was submitted by ESDIS and received by ECS on 4/23/96, to remove the requirement for TSDIS to get SSM/I data via ECS, and to instead get it directly from the LIS SCF. This is now the ECS default position.	5/96
3	5.1, 5.1.2, 5.2, 5.3.1, 5.3.2, 5.4.1	B	TBR - Date of TSDIS ICS document reflects latest version. The next version is expected to more accurately reflect the information referenced.	The date of the updated version of the ICS should be added to this ICD after it is published after ECS agrees to the changes affecting ECS. (via CCR)	6/96
4	5.5.2, 5.5.3, 4.4.7	B	TBR - Sources and Names of ancillary data products and associated file names not resolved.	ECS, ESDIS, and TSDIS will meet to resolve these, and then update the IRD and ICD.	5/96
5	Table 5-5 4.4.7	B	TBR - Data Types for Ancillary Data, Ephemeris and Housekeeping files not resolved.	ECS Data Modeling and Data Server groups will define these.	5/96

* Issue Priority Definition:

A = Design impact. E.g., unresolved interface.

B = Minimal design impact. E.g., content or format of a specific field unresolved.

C = No design impact - administrative detail. E.g., reference document # not available.

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Appendix AB. Abbreviations and Acronyms

ACL	Access Control List
ASCII	American Standard Code for Information Interchange
CAC	Climate Analysis Center
CCB	Configuration Control Board
CCSDS	Consultative Committee for Space Data Systems
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CERES	Clouds and Earth's Radiant Energy System
CIO	Contents Identifier Object
DAA	Data Availability Acknowledgment
DAAC	Distributed Active Archive Center
DAN	Data Availability Notice
DCN	Document Change Notice
DDA	Data Delivery Acknowledgment
DDN	Data Delivery Notice
DID	Data Item Description
DMR	Detailed Mission Requirements
DMSP	Defense Meteorological Satellite Program
DR	Data Request
DRA	Data Request Acknowledgment
DSA	Data Subscription Acknowledgment
DSR	Data Subscription Request
EBnet	EOSDIS Backbone Network
ECS	EOSDIS Core System
EDU	Exchange Data Unit
EOS	Earth Observing System

EOSDIS	EOS Data and Information System
ESDIS	Earth Science Data and Information System
FDD	Flight Dynamics Division
FDF	Flight Dynamics Facility
FNL	Final Analysis and Forecast System, Global Analysis
FNMOCC	Fleet Numerical Mission Operations Center
ftp	File Transfer Protocol
GB	Gigabyte
GOES	Geostationary Operational Environmental Satellite
GPCC	Global Precipitation Climatology Centre
GPCP	Global Precipitation Climatology Project
GPI	GOES Precipitation Index
GRIB	GRid In Binary
GSFC	Goddard Space Flight Center
GSOP	Ground System Operations Project
GV	Ground Validation
HDF	Hierarchical Data Format
HTML	HyperText Markup Language
ICD	Interface Control Document
IMS	Information Management System (ECS)
IP	Internet Protocol
IR	Infrared
IRD	Interface Requirements Document
ISO	International Standards Organization
kftp	Kerberos File Transfer Protocol
LAN	Local Area Network
LIS	Lightning Imaging Sensor
LVO	Label Value Object
MB	Megabyte

MSFC	Marshall Space Flight Center
MUA	Metadata Update Acknowledgment
MUR	Metadata Update Request
NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency of Japan
NESDIS	National Environmental Satellite Data and Information Service
NMC	National Meteorological Center (NOAA)
NOAA	National Oceanic and Atmospheric Administration
pdf	portable document format
POC	Product Order Cancellation
POCR	Product Order Cancellation Request
POS	Product Order Status
POSR	Product Order Status Request
PR	Precipitation Radar
PVL	Parameter Value Language
QA	Quality Assurance
RFC	Request for Comments
RIO	Reference Identifier Object
RPC	Remote Procedure Call
RST	Remote Science Terminal
rtf	rich text format
SCF	Science Computing Facility
SDOC	Science Data Operations Center
SDPF	Sensor Data Processing Facility
SDR	Sensor Data Record
SFDU	Standard Format Data Unit
SOCC	Science Operations Control Center
SSM/I	Special Sensor Microwave/Imager
TBD	To Be Determined

TBR	To Be Resolved
TBS	To Be Supplied
TCP	Transmission Control Protocol
TMI	TRMM Microwave Imager
TRMM	Tropical Rainfall Measuring Mission
TSDIS	TRMM Science Data and Information System
TSU	TSDIS Science User
VIRS	Visible and Infrared Scanner
WWW	World Wide Web